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ORIGINAL MEMOIRS.

INJURY AS A CAUSATIVE FACTOR IN CANCER.*

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THAT injury or trauma plays an important part in the development of all types of malignant tumors has been recognized by the laity from the earliest times. The question of the causative relationship between trauma and cancer has not until recently received the careful scientific investigation which its importance demands. At the French Congress of Surgery, 1907, it formed the chief topic of discussion, and at the recent International Cancer Research Congress of Paris, Oct. 5, 1910, two of the principal papers of the congress were devoted to it.

The most recent paper upon the subject in America is Phelps's article in the ANNALS OF SURGERY, May, 1910; it is an elaborate attempt to prove that trauma has no influence whatever upon the development of cancer (he limits the use of the word "cancer" to carcinoma). He admits that a "popular belief that a cancer of the breast can always be traced to some contusion or other trivial injury has existed to a very great extent," and he believes this profound belief "has been held with a tenacity which has hypnotized attending physicians into accepting impossible assertions as undoubted facts."

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In passing, it may be worth noting that popular beliefs of such long standing and so deeply rooted have, almost invariably, been proven in the end to be founded upon facts.

Phelps has attempted to answer the question, not by adding any new data based upon personal observations, but upon an analysis of opinions of other men, dating back as far as the earliest history of cancer. He states that he has no records of histories of cancer cases that have come under his own care.

Phelps at the outset states that he uses the word "cancer" to include only carcinoma and not sarcoma. I believe it better to use the word "cancer" to include all forms of malignant tumors, both of epithelial and connective-tissue origin, for the reason that up to comparatively recent times "cancer" was universally used in this broad, general way, both by the laity and the profession. We certainly need some word to include all types of malignant tumors, and no better term could be found than the word "cancer." Still further, the word "cancer" is at the present time used to include all malignant tumors by all the workers in cancer research throughout the world. So, then, in dealing with the question of trauma as a causative factor in malignant tumors, we shall consider all types of cancer. A careful study of all the varying types of malignant disease shows practically the same apparent causative influence from injury, although the percentage of cases associated with antecedent trauma may be slightly greater in sarcoma than carcinoma. But numerous cases of so-called acute traumatic malignancy will be found in all types.

The question cannot be settled by any review of old statistics, especially of hospital statistics taken by a house officer just beginning his experience in history-taking and usually following the routine custom handed down from previous generations of house surgeons. The only way the matter can be settled even approximately is by careful records of either a large number of personal observations or, better still, by the records of a large cancer hospital in which careful and uniform histories have been kept over a long period of years. Such records are, unfortunately, at the present time not in existence. The number of cases of cancer at any general hospital is too

small to give the required data without going back over a long period of years, too far to insure uniform methods in history-taking, and hence of little value in connection with such a question. Therefore, at present we must still rely on the results of large personal experiences, carefully and uniformly recorded. For the reason that 20 years ago I began to make special investigations in sarcoma, my opportunities for a study of this type of cancer have been unusually large, and it is the result of this personal experience, particularly in reference to the association of trauma and sarcoma, that I desire to place before you at this meeting. (My cases are all from histories taken myself.

Up to November 24, 1897, I had had under my care 170 cases of sarcoma and had careful histories of these cases. In a paper entitled "The Influence of Injury upon the Development of Sarcoma," read before the New York Surgical Society in November, 1897 (*ANNALS OF SURGERY*, March, 1898), I said that "no clinical feature of the disease had impressed me more strongly than the frequent association of trauma with its early manifestations." I started out with no theory to prove, but with an impartial mind, and I did not write my paper until I had personally seen 46 cases of antecedent trauma in a total of 170 cases of sarcoma observed. In that paper I gave a detailed history of each of these cases, and while in some the interval elapsing between injury and the development of the tumor was sufficiently long to justify some doubt as to any causative relationship, in most cases it was so short, that to rule it out as a coincidence without causative relationship would be begging the question.

In 9 of the 46 cases the tumor developed within one week following the injury at the exact site of injury.

Since writing this paper, I have observed 800 additional cases of sarcoma, making a total of 970 cases, and of the 800 new cases a definite history of trauma was noted in 179 cases; or in the entire series of 970 cases, 225 times, or 23 per cent. The tumor developed within the first month after the injury in 117 of the 225 cases, 52 per cent., of typical acute traumatic malignancy, the reality of which Phelps and others deny.

These cases are very briefly enumerated in the following tables. A number of the more important ones are given in greater detail in the body of the paper.

TABLE I.

SYNOPSIS OF CASES PREVIOUSLY PUBLISHED.¹

Case 1.—Age 18; female. Round-celled sarcoma. Site of tumor, metacarpal bone. Injury by blow. Interval between injury and appearance of tumor, at once.

Case 2.—Age 28; female. Round-celled sarcoma. Site of tumor, spine. Injury by fall. Interval between injury and appearance of tumor, 1 year.

Case 3.—Age 37; male. Melanotic sarcoma. Site of tumor, thumb. Injury by contusion. Interval between injury and appearance of tumor, at once.

Case 4.—Age 7; female. Mixed-celled sarcoma. Site of tumor, ovary. Injury by fall. Interval between injury and appearance of tumor, 2 months.

Case 5.—Age 55; female. Cylindroma. (Sarcoma.) Site of tumor, breast. Injury by blow. Interval between injury and appearance of tumor, 1 week.

Case 6.—Age 25; male. Round-celled sarcoma. Site of tumor, testis. Injury by blow. Interval between injury and appearance of tumor, 2 years.

Case 7.—Age 11; male. Round-celled sarcoma. Site of tumor, thigh (popliteal space). Injury by blow. Interval between injury and appearance of tumor, less than 1 year.

Case 8.—Age 59; male. Angiosarcoma. Site of tumor, breast. Injury by blow. Interval between injury and appearance of tumor, 3 months.

Case 9.—Age 41; female. Round-celled sarcoma. Site of tumor, arm. Injury by blow. Interval between injury and appearance of tumor, 2 years.

Case 10.—Age 46; female. Melanotic sarcoma. Site of tumor, neck. Injury by scratch. Interval between injury and appearance of tumor, soon.

Case 11.—Age 8; female. Round-celled sarcoma. Site of tumor, chest. Injury by blow. Interval between injury and appearance of tumor, 6 weeks.

Case 12.—Age 43; male. Round-celled sarcoma. Site of tumor, mastoid. Injury by severe blow. Interval between injury and appearance of tumor, 4½ years.

Case 13.—Age 20; female. Spindle-celled sarcoma. Site of tumor, hand. Injury by fall. Interval between injury and appearance of tumor, 1 year.

Case 14.—Age 31; female. Round-celled sarcoma. Site of tumor, breast. Injury by blow. Interval between injury and appearance of tumor, few days.

¹ ANNALS OF SURGERY, March, 1898.

Case 15.—Age 31; female. Site of tumor, breast. Injury by blow. Interval between injury and appearance of tumor, few days.

Case 16.—Age 11; female. Spindle-celled sarcoma. Site of tumor, femur. Injury by fall. Interval between injury and appearance of tumor, at once.

Case 17.—Age 26; female. Round-celled sarcoma. Site of tumor, femur. Injury by sprain. Interval between injury and appearance of tumor, 1 to 2 years.

Case 18.—Age 48; female. Spindle-celled sarcoma. Site of tumor, thigh. Injury by strain (muscular). Interval between injury and appearance of tumor, 2 years.

Case 19.—Age 29; male. Round-celled sarcoma. Site of tumor, testis. Injury by fall. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 20.—Age 22; male. Round-celled sarcoma. Site of tumor, testis. Injury by fall and contusion. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 21.—Age 27; female. Round-celled sarcoma. Site of tumor, axilla. Injury by laceration (finger). Interval between injury and appearance of tumor, 1 week.

Case 22.—Age 55; male. Mixed-celled sarcoma. Site of tumor, parotid. Injury by blow. Interval between injury and appearance of tumor, 4 to 6 weeks.

Case 23.—Age 11; female. Round-celled sarcoma. Site of tumor, calf of leg. Injury by fall. Interval between injury and appearance of tumor, 2 to 3 months.

Case 24.—Age 14; male. Round-celled sarcoma. Site of tumor, ribs. Injury by blow. Interval between injury and appearance of tumor, 6 months.

Case 25.—Age 53; male. Mixed-celled sarcoma. Site of tumor, parotid. Injury by blow. Interval between injury and appearance of tumor, 5 years.

Case 26.—Age 14; male. Osteosarcoma. Site of tumor, ilium. Injury by contusion. Interval between injury and appearance of tumor, 1½ years.

Case 27.—Age 30; male. Round-celled sarcoma. Site of tumor, clavicle. Injury by fracture. Interval between injury and appearance of tumor, 1½ years.

Case 28.—Age 26; male. Round-celled sarcoma. Site of tumor, femur. Injury by sprain. Interval between injury and appearance of tumor, few weeks.

Case 29.—Age 55; male. Round-celled sarcoma (myxosarcoma). Site of tumor, thigh. Injury by gun-shot wound. Interval between injury and appearance of tumor, 25 years.

Case 30.—Age 27; female. Round-celled sarcoma. Site of tumor, breast. Injury by burn (carbolic acid). Interval between injury and appearance of tumor, 3 months.

Case 31.—Age 36; male. Osteochondroma sarcoma. Site of tumor,

shoulder. Injury by sprain. Interval between injury and appearance of tumor, 6 months.

Case 32.—Age 30; female. Osteochondroma sarcoma. Site of tumor, ilium. Injury by fall. Interval between injury and appearance of tumor, 3 months.

Case 33.—Age 38; female. Osteochondroma sarcoma. Site of tumor, lower jaw. Injury by blow. Interval between injury and appearance of tumor, few weeks.

Case 34.—Age 29; male. Mixed-celled sarcoma. Site of tumor, eye. Injury by scratch. Interval between injury and appearance of tumor, few weeks.

Case 35.—Age 55; male. Round-celled sarcoma (melanotic). Site of tumor, ball of foot. Injury by laceration from nail in shoe. Interval between injury and appearance of tumor, few weeks.

Case 36.—Age 12; male. Round-celled sarcoma. Site of tumor, tibia. Injury by fall. Interval between injury and appearance of tumor, 2 months.

Case 37.—Age 5; female. Round-celled sarcoma. Site of tumor, femur. Injury of old fracture. Interval between injury and appearance of tumor, 1 to 2 years.

Case 38.—Age 24; female. Round-celled sarcoma (melanotic). Site of tumor, tibia. Injury by fall. Interval between injury and appearance of tumor, at once.

Case 39.—Age 16; female. Spindle-celled sarcoma. Site of tumor, foot. Injury by fall. Interval between injury and appearance of tumor, few weeks.

Case 40.—Age 26; male. Round-celled sarcoma. Site of tumor, tibia. Injury by blow. Interval between injury and appearance of tumor, few weeks.

Case 41.—Age 50; male. Round-celled sarcoma. Site of tumor, kidney. Injury by fall and contusion. Interval between injury and appearance of tumor, 6 months.

Case 42.—Age 40; male. Spindle-celled sarcoma. Site of tumor, parotid. Injury by blow. Interval between injury and appearance of tumor, few months.

Case 43.—Age 39; female. Melanotic sarcoma. Site of tumor, foot. Injury by contusion. Interval between injury and appearance of tumor, few weeks.

Case 44.—Age 50; female. Melanotic sarcoma. Site of tumor, leg. Injury by scratch. Interval between injury and appearance of tumor, few days.

Case 45.—Age 73; male. Round-celled sarcoma. Site of tumor, tonsil. Injury by contusion. Interval between injury and appearance of tumor, 5 days.

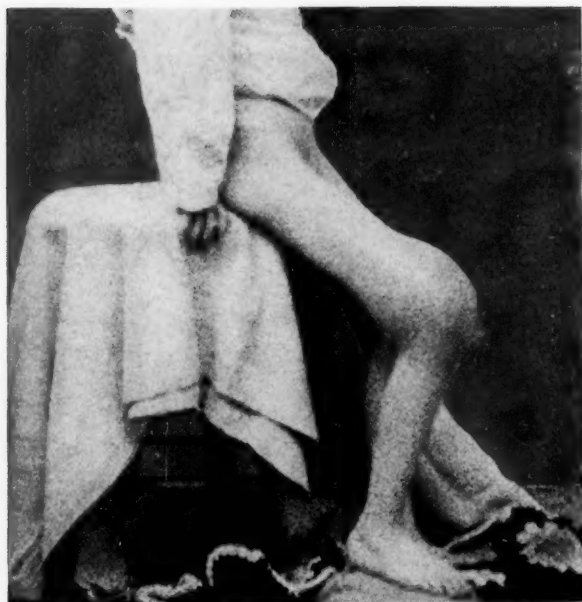
Case 46.—Age 23; female. Osteochondroma sarcoma. Site of tumor, ilium. Injury by fall. Interval between injury and appearance of tumor, 2 injuries, 1 ten years, 1 two years before.

FIG. 1.



Periosteal round-celled sarcoma;
appeared 2-3 weeks after sprain. (Case
28, Table I.)

FIG. 2.



Sarcoma of femur (following trauma). Amputation of hip-joint. (Case 37, Table I.)

FIG. 3.



Sarcoma of upper end of femur. First noticed 3 weeks after fall from tree. (Case 4, Table II.)

FIG. 4.



Fibroma, later changing to fibrosarcoma, finally causing death.
Followed blow on back of head by baseball bat.

FIG. 5.



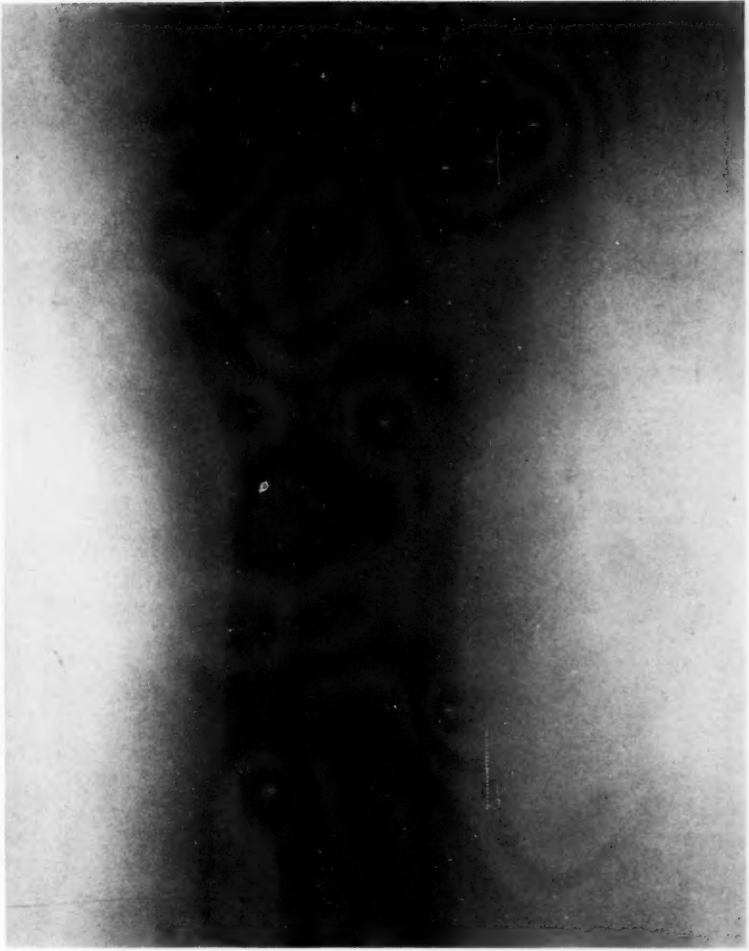
Sarcoma of forehead; developed 2-3 weeks after blow against sharp corner of bureau. (Case 49, Table II.)

FIG. 6.



Simple spiral fracture of humerus. X-ray taken through plaster splint, a few days after injury.

FIG. 7.



Same case, showing well-developed sarcoma at site of fracture. X-ray taken 2 months later.

FIG. 8.



Same case after 4 months' treatment with the mixed toxins of erysipelas and *Bacillus prodigiosus*. Almost complete disappearance of the tumor. New formation of bone and reunion of pathological fracture.

FIG. 9.



Round-celled sarcoma originating in scar (cicatrix) of a hernia operation, within 4 weeks after operation. Associated with a sarcoma of upper jaw, occurring just before. Caused death in three months.

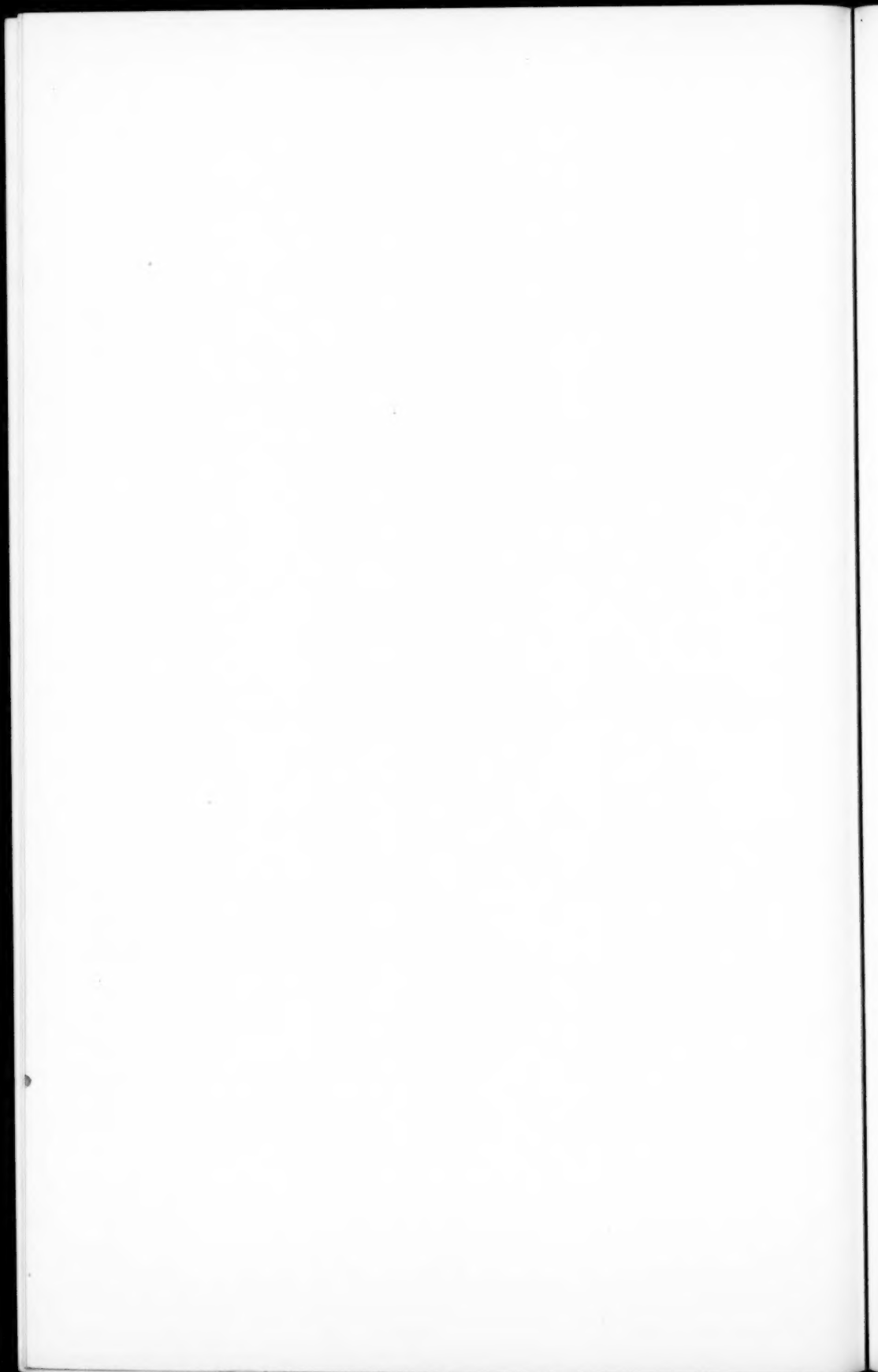


TABLE II.

CASES OF SARCOMA WITH ANTECEDENT TRAUMA, PERSONALLY OBSERVED
SINCE 1898.

Case 1.—H. C., age 15; male. (1909.) Site of tumor, ribs. Character of injury, run over by carriage. Interval between injury and appearance of tumor, 3 months.

Case 2.—M. D., age 10; female. (1902.) Site of tumor, skull. Character of injury, blow from stone thrown by boy. Interval between injury and appearance of tumor, 2 months.

Case 3.—W. D., age 15; female. (1907.) Site of tumor, scrotum. Character of injury, fall from bicycle. Interval between injury and appearance of tumor, few weeks.

Case 4.—D., age 16; male. (1907.) Site of tumor, femur. Character of injury, fall from tree. Interval between injury and appearance of tumor, 3 weeks.

Case 5.—E., age 29; male. (1904.) Site of tumor, scalp, head. Character of injury, struck by baseball bat. Interval between injury and appearance of tumor, 2 years. Fibroma, changing to sarcoma.

Case 6.—F., age 35; female. (1906.) Site of tumor, cheek. Character of injury, mole tied off with silk. Interval between injury and appearance of tumor, few days. Melanotic.

Case 7.—F., age 45; female. (1906.) Site of tumor, forearm. Character of injury, blow (bruise). Interval between injury and appearance of tumor, 2 to 3 weeks. Round-celled.

Case 8.—F., age 41; female. (1896.) Site of tumor, humerus. Character of injury, struck with rake handle. Interval between injury and appearance of tumor, 2 years. Round-celled.

Case 9.—F., age 26; female. (1908.) Site of tumor, radius. Character of injury, fall. Interval between injury and appearance of tumor, 1st, 3 years; 2d, 2 to 8 weeks. Round-celled, central.

Case 10.—F., age 24; female. (1906.) Site of tumor, ulna. Character of injury, blow, contusion. Interval between injury and appearance of tumor, 1 month.

Case 11.—S., age 52; female. (1898.) Site of tumor, fibula. Character of injury, fall. Interval between injury and appearance of tumor, 3 months.

Case 12.—H., age 56; male. (1898.) Site of tumor, heel. Character of injury, from nail in shoe. Interval between injury and appearance of tumor, few months. Round-celled, melanotic.

Case 13.—F., age 47; male. (1908.) Site of tumor, heel. Character of injury, blister from shoe. Interval between injury and appearance of tumor, few days. Melanotic.

Case 14.—B., age 28; female. (1901.) Site of tumor, thigh. Character of injury, fall from bicycle. Interval between injury and appearance of tumor, 2 years.

Case 15.—B., age 60; female. (1905.) Site of tumor, neck. Character of injury, strain. Interval between injury and appearance of tumor, few days.

Case 16.—S., age 47; female. Site of tumor, thigh. Character of injury, struck by sharp corner of marble-top table. Interval between injury and appearance of tumor, 1 year.

Case 17.—B., age 12; male. (1908.) Site of tumor, ilium. Character of injury, struck by baseball bat. Interval between injury and appearance of tumor, 5 months.

Case 18.—B., age 25; male. (1899.) Site of tumor, superior maxilla. Character of injury, fall from bicycle. Interval between injury and appearance of tumor, 4 months.

Case 19.—B., age 51; male. (1889.) Site of tumor, thumb. Character of injury, blow. Interval between injury and appearance of tumor, few months.

Case 20.—B., age 65; female. (1895.) Site of tumor, orbit. Character of injury, blow. Interval between injury and appearance of tumor, few months.

Case 21.—A., age 31; male. (1895.) Site of tumor, testis. Character of injury, 2 severe injuries to same testis. Interval between injury and appearance of tumor, 1st, 10 years; 2d, 9 years.

Case 22.—B., age 36; female. (1898.) Site of tumor, foot. Character of injury, stepped on by horse, severe bruise. Interval between injury and appearance of tumor, 2 to 3 months.

Case 23.—A., age 43; male. (1903.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few days.

Case 24.—A., age 26; male. (1902.) Site of tumor, forearm. Character of injury, severe strain getting off car. Interval between injury and appearance of tumor, 3 months.

Case 25.—R., age 41; female. (1906.) Site of tumor, ear. Character of injury, blow. Interval between injury and appearance of tumor, few days. Pigmented mole; melanotic sarcoma.

Case 26.—A., age 44; male. (1901.) Site of tumor, mesenteric glands. Character of injury, severe contusion of abdomen. Interval between injury and appearance of tumor, symptoms directly after injury. Tumor few months. Round-celled.

Case 27.—G., age 35; male. (1909.) Site of tumor, femur. Character of injury, fall, bruise. Interval between injury and appearance of tumor, few days—1 week.

Case 28.—N., age 24; male. (1904.) Site of tumor, testis. Character of injury, blow. Interval between injury and appearance of tumor, 7 weeks.

Case 29.—S., age 51; male. (1907.) Site of tumor, superior maxilla. Character of injury, blow, struck by piece of timber. Interval between injury and appearance of tumor, 5 months.

Case 30.—W., age 28; male. (1909.) Site of tumor, femur. Character of injury, contusion. Interval between injury and appearance of tumor, 5 months.

Case 31.—G., age 6½; male. (1899.) Site of tumor, hand. Character of injury, fall, bruise. Interval between injury and appearance of tumor, few days. Spindle-celled.

Case 32.—G., age 42, male. (1901.) Site of tumor, testis. Character of injury, blow, contusion. Interval between injury and appearance of tumor, few days.

Case 33.—G., age 45; female. (1905.) Site of tumor, calf of leg. Character of injury, injured pigmented mole while riding. Interval between injury and appearance of tumor, few days. Melanotic.

Case 34.—G., age 48; male. (1908.) Site of tumor, testis. Character of injury, contusion, riding horseback. Interval between injury and appearance of tumor, few days.

Case 35.—H., age 28; male. (1902.) Site of tumor, superior maxilla. Character of injury, thrown from carriage, contusion. Interval between injury and appearance of tumor, 2 years.

Case 36.—G., age 14; male. (1906.) Site of tumor, ilium. Character of injury, fell down stairs; injury to left shoulder; 1 year later, fell down again. Interval between injury and appearance of tumor, few weeks after second injury.

Case 37.—V., age 42; female. (1900.) Site of tumor, thigh. Character of injury, ran against door, contusion. Interval between injury and appearance of tumor, 6 weeks.

Case 38.—V., age 28; male. (1904.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few weeks. Round-celled.

Case 39.—T., age 39; male. (1909.) Site of tumor, scapular region. Character of injury, severe contusion. Interval between injury and appearance of tumor, 1 month. Round-celled.

Case 40.—R., age 25; male. (1906.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, 10 years.

Case 41.—F., age 43; female. (1905.) Site of tumor, retroperitoneum. Character of injury, fall. Interval between injury and appearance of tumor, 8 years.

Case 42.—F., age 29; male. (1908.) Site of tumor, pectoral region. Character of injury, strain of pectoral muscle. Interval between injury and appearance of tumor, soon.

Case 43.—M., age 40; male. (1907.) Site of tumor, little toe. Character of injury, run over by auto. Interval between injury and appearance of tumor, few days later.

Case 44.—H., age 45; male. Site of tumor, face. Character of injury, applied caustic to pigmented mole. Interval between injury and appearance of tumor, few days. Melanotic.

Case 45.—H., age 8; female. (1895.) Site of tumor, face. Character of injury, severe slap on face. Interval between injury and appearance of tumor, 6 weeks later.

Case 46.—S., age 42; male. (1905.) Site of tumor, femur. Character of injury, severe wrench of knee. Interval between injury and appearance of tumor, 10 months.

Case 47.—T., age 39; male. (1899.) Site of tumor, thigh. Character of injury, run over by truck. Interval between injury and appearance of tumor, 6 months.

Case 48.—T., age 46; male. (1904.) Site of tumor, testis. Character of injury, fell astride barrel, injuring right testis when boy. Interval between injury and appearance of tumor, 25 years.

Case 49.—T., age 60; female. (1907.) Site of tumor, forehead, frontal bone. Character of injury, struck forehead against sharp corner of bureau. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 50.—V., age 33; male. (1906.) Site of tumor, tibia. Character of injury, twist of knee. Interval between injury and appearance of tumor, 10 months.

Case 51.—T., age 45; male. (1906.) Site of tumor, ulna. Character of injury, severe strain (twist). Interval between injury and appearance of tumor, few weeks.

Case 52.—S., age 21; male. (1908.) Site of tumor, forearm. Character of injury, blow, football. Interval between injury and appearance of tumor, few weeks.

Case 53.—S., age 50; female. (1893.) Site of tumor, gluteal region. Character of injury, fall, striking buttock on edge of board. Interval between injury and appearance of tumor, few days (1 week).

Case 54.—S., age 51; male. (1906.) Site of tumor, gluteal region. Character of injury, trauma to pigmented mole. Interval between injury and appearance of tumor, at once. Melanotic sarcoma.

Case 55.—S., age 10; male. (1901.) Site of tumor, ilium. Character of injury, fall down stairs. Interval between injury and appearance of tumor, 1 month.

Case 56.—S., age 53; male. (1897.) Site of tumor, parotid. Character of injury, blow. Interval between injury and appearance of tumor, 5 years.

Case 57.—S., age 32; male. (1907.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, 8 months.

Case 58.—C., age 15; male. (1909.) Site of tumor, femur. Character of injury, fell 30 feet; 2 years later second fall, fracturing femur; sarcoma developed in callus. Interval between injury and appearance of tumor, 2 months. Round-celled.

Case 59.—S., age 21; male. (1893.) Site of tumor, clavicle. Character of injury, fracture. Interval between injury and appearance of tumor, 1 year. Round-celled.

Case 60.—C., age 55; female. (1908.) Site of tumor, femur. Character of injury, blow. Interval between injury and appearance of tumor, soon; few weeks. Large spindle- and giant-celled.

Case 61.—C., age 27; male. (1901.) Site of tumor, thigh. Character of injury, blow playing baseball. Interval between injury and appearance of tumor, 2 months.

Case 62.—C., age 10; male. (1909.) Site of tumor, tibia. Character of injury, bruise (blow). Interval between injury and appearance of tumor, 8 months.

Case 63.—C., age 37; male. (1908.) Site of tumor, pectoral region. Character of injury, strain of muscle. Interval between injury and appearance of tumor, few days later.

Case 64.—C., age 30; male. (1904.) Site of tumor, thigh. Character of injury, blow. Interval between injury and appearance of tumor, soon; 2 to 3 weeks.

Case 65.—C., age 23; male. (1907.) Site of tumor, thigh. Character of injury, pigmented mole tied off with silk. Interval between injury and appearance of tumor, few days. Melanotic.

Case 66.—H., age 20; male. (1906.) Site of tumor, tibia. Character of injury, sprain. Interval between injury and appearance of tumor, soon, few weeks. Round-celled, periosteal.

Case 67.—H., age 42; male. (1907.) Site of tumor, kidney. Character of injury, kick. Interval between injury and appearance of tumor, 2½ years.

Case 68.—H., age 29; female. (1907.) Site of tumor, radius. Character of injury, severe blow. Interval between injury and appearance of tumor, 5 months. Giant-celled.

Case 69.—H., age 15; male. (1908.) Site of tumor, femur. Character of injury, fall, injuring upper part of femur. Interval between injury and appearance of tumor, 3 months. Periosteal upper third.

Case 70.—H., age 46; male. (1908.) Site of tumor, humerus. Character of injury, fall. Interval between injury and appearance of tumor, 4 weeks.

Case 71.—J., age 8; male. (1901.) Site of tumor, back. Character of injury, severe bruise from fall. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 72.—J., age 59; female. (1909.) Site of tumor, heel. Character of injury, trauma from nail in shoe. Interval between injury and appearance of tumor, soon. Tumor; stationary several years.

Case 73.—J., age 31; male. (1908.) Site of tumor, neck. Character of injury, muscular strain. Interval between injury and appearance of tumor, 4 weeks.

Case 74.—K., age 49; male. (1889.) Site of tumor, neck. Character of injury, blow from block of wood. Interval between injury and appearance of tumor, 4 months.

Case 75.—K., age 23; male. (1900.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, 1 year.

Case 76.—K., age 51; male. (1898.) Site of tumor, clavicle. Character of injury, carried heavy bar of steel on shoulder one-quarter mile. Interval between injury and appearance of tumor, 1 month later tumor exact site.

Case 77.—K., age 1; female. (1894.) Site of tumor, metatarsal bone. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 78.—L., age 18; female. (1898.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, 2 months.

Case 79.—L., age 40; female. (1899.) Site of tumor, face. Character of injury, blow from fist. Interval between injury and appearance of tumor, few days.

Case 80.—L., age 35; female. (1906.) Site of tumor, pubic bone. Character of injury, injury by forceps delivery; severe labor. Interval between injury and appearance of tumor, 2 months.

Case 81.—L., age 35; male. (1905.) Site of tumor, inguinal region. Character of injury, slipped, with severe strain of muscles in groin. Interval between injury and appearance of tumor, few weeks.

Case 82.—L., age 44; female. (1906.) Site of tumor, thigh. Character of injury, strain. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 83.—L., age 13, male. (1906.) Site of tumor, supraclavicular glands. Character of injury, strain. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 84.—L. age 31; male. (1904.) Site of tumor, testis. Character of injury, severe kick. Interval between injury and appearance of tumor, soon after; few days.

Case 85.—L., age 33; male. (1908.) Site of tumor, mole on ankle. Character of injury, cauterized. Interval between injury and appearance of tumor, at once. Melanotic.

Case 86.—L., age 43; female. (1906.) Site of tumor, gluteal region. Character of injury, knocked down by bicycle, striking on buttock. Interval between injury and appearance of tumor, 1 year.

Case 87.—L., age 11 months; male. (1907.) Site of tumor, tibia. Character of injury, strain. Interval between injury and appearance of tumor, 2 days.

Case 88.—O., age 62; male. (1898.) Site of tumor, clavicle. Character of injury, severe blow by beam. Interval between injury and appearance of tumor, 9 years, exact spot.

Case 89.—O., age 13; male. (1909.) Site of tumor, back. Character of injury, fell from hammock to hard floor. Interval between injury and appearance of tumor, 1½ years.

Case 90.—P., age 29; male. (1908.) Site of tumor, ilium. Character of injury, thrown from horse, dragged 21 feet. Interval between injury and appearance of tumor, 8 years.

Case 91.—P., age 32; female. (1908.) Site of tumor, buttock. Character of injury, fell through broken floor; severe bruise. Interval between injury and appearance of tumor, few days. Round-celled.

Case 92.—P., age 45; male. (1902.) Site of tumor, pectoral region. Character of injury, severe muscular strain. Interval between injury and appearance of tumor, 6 months.

Case 93.—S., age 42; female. (1906.) Site of tumor, toe. Character of injury, heavy iron fell on toe; 4 years later second injury, heavy iron on same toe. Interval between injury and appearance of tumor, first injury 4 years developed soon; few weeks after second injury.

Case 94.—L., age 45; male. (1906.) Site of tumor, parotid. Character of injury, severe blow; fell on log. Interval between injury and appearance of tumor, 3 years.

Case 95.—M., age 10; female. (1907.) Site of tumor, tibia. Character of injury, blow. Interval between injury and appearance of tumor, 4 months.

Case 96.—L., age 59; female. Site of tumor, femur. Character of injury, fall from street car. Interval between injury and appearance of tumor, 6 months.

Case 97.—L., age 21; male. (1906.) Site of tumor, ribs. Character of injury, fall; fractured ribs. Interval between injury and appearance of tumor, few weeks.

Case 98.—M., age 37; male. (1900.) Site of tumor, thigh. Character of injury, blow against heavy lounge. Interval between injury and appearance of tumor, 2 weeks.

Case 99.—M., age 55; male. (1903.) Site of tumor, humerus. Character of injury, blow. Interval between injury and appearance of tumor, few days.

Case 100.—M., age 10; male. (1908.) Site of tumor, ilium. Character of injury, ran against telephone pole; bruise of thigh. Interval between injury and appearance of tumor, 2 weeks.

Case 101.—M., age 41; female. (1900.) Site of tumor, breast. Character of injury, fall from bicycle, bruising breast. Interval between injury and appearance of tumor, 1 year.

Case 102.—B., age 52; male. (1908.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 103.—M., age 27; male. (1898.) Site of tumor, testis. Character of injury, blow. Interval between injury and appearance of tumor, small tumor appeared almost at once; remained dormant 6 years, then began to grow. Round-celled.

Case 104.—M., age 28; male. (1899.) Site of tumor, testis. Character of injury, fall from bicycle. Interval between injury and appearance of tumor, 1 year.

Case 105.—M., age 22; male. (1898.) Site of tumor, ischium. Character of injury, fall on ice, striking tuberosity of ischium. Interval between injury and appearance of tumor, few days later.

Case 106.—M., age 37; female. (1898.) Site of tumor, inferior maxilla. Character of injury, severe blow. Interval between injury and appearance of tumor, 2 to 3 months.

Case 107.—M., age 55; male. (1898.) Site of tumor, parotid. Character of injury, severe blow from horse's head. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 108.—M., age 8; male. (1902.) Site of tumor, superior maxilla. Character of injury, fell from bicycle, driving eye-tooth into upper jaw. Interval between injury and appearance of tumor, 1½ years.

Case 109.—M., age 46; male. (1905.) Site of tumor, ischium. Character of injury, fall. Interval between injury and appearance of tumor, 2 years.

Case 110.—N., age 38; male. (1907.) Site of tumor, ischium. Character of injury, fall on sidewalk, striking tuberosity of ischium. Interval between injury and appearance of tumor, 2 months.

Case 111.—S., age 25; male. (1906.) Site of tumor, ulna. Character of injury, green stick fracture. Interval between injury and appearance of tumor, 2 to 3 months; began in callus.

Case 112.—W., age 46; female. (1909.) Site of tumor, supraclavicular glands. Character of injury, blow from falling window. Interval between injury and appearance of tumor, 1 week.

Case 113.—W., age 60; male. (1899.) Site of tumor, inferior maxilla. Character of injury, piece of jaw broken off in extracting tooth. Interval between injury and appearance of tumor, few weeks.

Case 114.—H., age 35; male. (1906.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few months (2 to 3).

Case 115.—W., age 20; female. (1900.) Site of tumor, tibia. Character of injury, fall. Interval between injury and appearance of tumor, 1½ years. Round-celled.

Case 116.—W., age 15; female. (1907.) Site of tumor, humerus. Character of injury, blow. Interval between injury and appearance of tumor, 10 years. Round-celled.

Case 117.—C., age 37; male. (1898.) Site of tumor, groin. Character of injury, blow; ran against corner of table. Interval between injury and appearance of tumor, few days.

Case 118.—C., age 25; female. (1899.) Site of tumor, parotid. Character of injury, blow from baseball. Interval between injury and appearance of tumor, 2 years.

Case 119.—C., age 36; female. (1898.) Site of tumor, scalp. Character of injury, heavy blow from falling window. Interval between injury and appearance of tumor, few days.

Case 120.—V., age 16; male. (1909.) Site of tumor, clavicle. Character of injury, severe muscular strain. Interval between injury and appearance of tumor, 3 weeks.

Case 121.—L., age 32; male. (1910.) Site of tumor, humerus. Character of injury, fracture. Interval between injury and appearance of tumor, 5 to 6 weeks.

Case 122.—F., age 46; female. (1910.) Site of tumor, tibia. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 123.—H., age 63; male. (1910.) Site of tumor, back. Character of injury, fall. Interval between injury and appearance of tumor, 4 years.

Case 124.—G., age 31; male. (1910.) Site of tumor, calf of leg. Character of injury, trauma to pigmented mole. Interval between injury and appearance of tumor, at once. Melanotic.

Case 125.—M., age 42; male. (1904.) Site of tumor, testis. Character of injury, contusion. Interval between injury and appearance of tumor, 2 to 3 months.

Case 126.—F., age 38; male. (1906.) Site of tumor, clavicle. Character of injury, severe muscular strain. Interval between injury and appearance of tumor, 1 week.

Case 127.—O., age 11; male. Site of tumor, rectus muscle. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 128.—G., age 14; male. (1910.) Site of tumor, tibia. Char-

acter of injury, sprain of leg. Interval between injury and appearance of tumor, few days; later pain and swelling.

Case 129.—W., age 19; male. (1897.) Site of tumor, thigh. Character of injury, pigmented mole ligated with silk. Interval between injury and appearance of tumor, few days. Melanotic.

Case 130.—D., age 33; male. (1899.) Site of tumor, thigh. Character of injury, bad fall; rendered unconscious. Interval between injury and appearance of tumor, 6 months.

Case 131.—G., age 21; male. (1902.) Site of tumor, back. Character of injury, wrenched back wrestling. Interval between injury and appearance of tumor, few weeks.

Case 132.—H., age 24; male. (1899.) Site of tumor, superior maxilla. Character of injury, piece of jaw broken off extracting tooth. Interval between injury and appearance of tumor, 2 months.

Case 133.—H., age 18; male. (1899.) Site of tumor, humerus. Character of injury, fell 3 stories, injuring shoulder. Interval between injury and appearance of tumor, 2 months.

Case 134.—L., age 44; female. (1903.) Site of tumor, inferior maxilla. Character of injury, jaw injured in extracting tooth. Interval between injury and appearance of tumor, 2 months.

Case 135.—M., age 58; male. (1899.) Site of tumor, humerus. Character of injury, injured shoulder against trolley car. Interval between injury and appearance of tumor, 1 month.

Case 136.—M., age 29; male. (1910.) Site of tumor, sacro-iliac. Character of injury, sprain. Interval between injury and appearance of tumor, few weeks.

Case 137.—M., age 37; female. (1902.) Site of tumor, foot. Character of injury, trauma to pigmented mole. Interval between injury and appearance of tumor, few weeks. Melanotic.

Case 138.—N., age 2 months; male. (1910.) Site of tumor, scapula. Character of injury, difficult birth; left shoulder strained. Interval between injury and appearance of tumor, 2 weeks.

Case 139.—R., age 35; male. (1905.) Site of tumor, undescended testis. Character of injury, trauma, from application of truss. Interval between injury and appearance of tumor, few weeks; pain and swelling. Round-celled.

Case 140.—R., age 34; female. (1910.) Site of tumor, fibula. Character of injury, kicked by horse, 1897. Interval between injury and appearance of tumor, tumor (bony) few weeks later at site of injury. Quiescence 5 years, then rapidly growing spindle-celled sarcoma.

Case 141.—R., age 46; male. (1907.) Site of tumor, orbit. Character of injury, blow. Interval between injury and appearance of tumor, few days.

Case 142.—T., age 52; male. (1903.) Site of tumor, pectoral region. Character of injury, trauma of pigmented mole. Interval between injury and appearance of tumor, at once. Melanotic.

Case 143.—L., age 24; female. (1899.) Site of tumor, thigh. Character of injury, repeated trauma, sitting on hard chair at sewing machine.

Interval between injury and appearance of tumor, tumor developed just where edge of chair touched thigh. Round-celled.

Case 144.—S., age 5½; male. (1899.) Site of tumor, groin. Character of injury, fall. Interval between injury and appearance of tumor, few days.

Case 145.—W., age 55; male. (1901.) Site of tumor, thigh. Character of injury, trauma to pigmented mole. Interval between injury and appearance of tumor, few days.

Case 146.—H., age 34; male. (1908.) Site of tumor, clavicle. Character of injury, heavy plank fell on shoulder. Interval between injury and appearance of tumor, 6 years.

Case 147.—A., age 32; female. (1909.) Site of tumor, thigh. Character of injury, trauma of pigmented mole (electrocautery). Interval between injury and appearance of tumor, at once.

Case 148.—B., age 49; male. (1900.) Site of tumor, femur. Character of injury, fracture from kick of horse. Interval between injury and appearance of tumor, 2 to 3 months.

Case 149.—W., age 50; male. (1910.) Site of tumor, thigh. Character of injury, blow. Interval between injury and appearance of tumor, few weeks. Spindle-celled.

Case 150.—J., age 19; female. (1910.) Site of tumor, hand. Character of injury, sprain. Interval between injury and appearance of tumor, few weeks.

Case 151.—H., age 58; female. (1901.) Site of tumor, breast (skin). Character of injury, fall. Interval between injury and appearance of tumor, 2 years. Melanotic.

Case 152.—G., age 32; male. (1901.) Site of tumor, abdominal wall. Character of injury, fell down stairs. Interval between injury and appearance of tumor, 2 to 3 months.

Case 153.—K., age 37; male. (1906.) Site of tumor, shoulder (humerus). Character of injury, strain. Interval between injury and appearance of tumor, 1 month.

Case 154.—M., age 46; male. (1903.) Site of tumor, clavicle. Character of injury, dislocation of shoulder. Interval between injury and appearance of tumor, 2 to 3 months later. Round-celled.

Case 155.—H., age 40; male. (1908.) Site of tumor, clavicle. Character of injury, severe contusion from falling bar of steel. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 156.—W., age 37; male. (1900.) Site of tumor, thigh. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 157.—K., age 10; male. (1911.) Site of tumor, groin. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 158.—K., age 16; female. (1904.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, few months.

Case 159.—P., age 35; female. (1910.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, 6 months.

Case 160.—F., age 52; female. (1898.) Site of tumor, fibula. Character of injury, fall. Interval between injury and appearance of tumor, 2 months.

Case 161.—T., age 35; female. (1898.) Site of tumor, thigh. Character of injury, fall. Interval between injury and appearance of tumor, few days.

Case 162.—M., age 41; female. (1900.) Site of tumor, breast. Character of injury, fall; contusion of breast. Interval between injury and appearance of tumor, 1 year.

Case 163.—Q., age 60; female. (1899.) Site of tumor, leg. Character of injury, ligature of pigmented mole. Interval between injury and appearance of tumor, at once.

Case 164.—K., age 18; male. (1909.) Site of tumor, foot. Character of injury, tearing ligament; forcible correction of flat-foot. Interval between injury and appearance of tumor, 2 weeks.

Case 165.—H., age 10; male. (1910.) Site of tumor, inguinal canal. Character of injury, scar of hernia operation. Interval between injury and appearance of tumor, 5 weeks after operation. Very malignant.

Case 166.—S., age 6; male. (1897.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 167.—S., age 40; male. (1906.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few months.

Case 168.—U., age 45; male. (1905.) Site of tumor, thigh. Character of injury, blow. Interval between injury and appearance of tumor, few months.

Case 169.—T., age 58; female. (1905.) Site of tumor, forehead. Character of injury, blow. Interval between injury and appearance of tumor, 1 month.

Case 170.—M., age 52; female. (1906.) Site of tumor, breast. Character of injury, blow. Interval between injury and appearance of tumor, 2 weeks.

Case 171.—D., age 15; male. (1906.) Site of tumor, sacrum. Character of injury, sprain. Interval between injury and appearance of tumor, few weeks.

Case 172.—V., age 33; male. (1906.) Site of tumor, tibia. Character of injury, fall; twist of knee. Interval between injury and appearance of tumor, 10 months.

Case 173.—B.; female. (1910.) Site of tumor, shoulder. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 174.—B., age 16; male. (1910.) Site of tumor, coccyx. Character of injury, kick. Interval between injury and appearance of tumor, 1 week.

Case 175.—C., age 40; male. (1908.) Site of tumor, toe. Character of injury, run over by auto. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 176.—M., age 19; female. (1904.) Site of tumor, femur.

Character of injury, fracture. Interval between injury and appearance of tumor, few weeks.

Case 177.—M., age 8; male. (1906.) Site of tumor, clavicle. Character of injury, fall from wire fence. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 178.—S., age 5; male. (1911.) Site of tumor, back; extraspinal. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 179.—S., age 14; male. (1910.) Site of tumor, sacrolumbar spine. Character of injury, fall on ice; severe blow in sacral region. Interval between injury and appearance of tumor, pain severe 2 months later; swelling 6 months later.

From the foregoing tables, comprising 225 cases (46 old and 179 new), it will be seen that 105 or 46.66 per cent. of the cases originated in the bone; 120 or 53.33 per cent. in the soft parts.

They were distributed as follows:

BONES.

Femur	21	Spine	2
Fibula and tibia.....	15	Pubic bone	1
Humerus	7	Ribs	3
Ulna	3	Mastoid	1
Radius	2	Skull	1
Metatarsal bone	2	Orbit	3
Clavicle	10	Forehead	2
Scapula	4	Superior maxilla	5
Ilium	15	Inferior maxilla	3
Ischium	3		
Sacrum	1	Total	105
Coccyx	1		

SOFT PARTS.

Thigh	19	Back	5
Leg	5	Chest	1
Inguinal region	4	Supraclavicular glands	2
Ankle	1	Scapular region	1
Foot	7	Neck	4
Toe	3	Tonsil	1
Heel	3	Parotid	8
Forearm	4	Face	3
Hand	3	Scalp	2
Thumb	1	Cheek	1
Abdomen	3	Ear	1
Rectus muscle	1	Testis	13
Kidney	2	Scrotum	1
Gluteal region	5	Ovary	2
Breast, pectoral region, and axilla	14	Total	120

The interval elapsing between the injury and the appearance of the tumor was as follows:

Less than 1 week.....	50	6 to 12 months.....	15
1 to 2 weeks.....	13	1 to 2 years.....	17
2 weeks to a month.....	54	2 to 3 years.....	5
1 to 2 months.....	23	Over 3 years.....	17
2 to 6 months.....	31		

117 cases within one month after injury.

TABLE III.

CASES OF CARCINOMA OF BREAST ASSOCIATED WITH ANTECEDENT TRAUMA.

Case 1.—B., age 43; female. (1909.) Site of tumor, breast, double. Character of injury, caught on door of elevated train; severe bruises both breasts. Interval between injury and appearance of tumor, 6 years later; tumor began in both breasts 3 weeks apart.

Case 2.—B., age 59; female. (1910.) Site of tumor, right breast. Character of injury, fall, striking breast on back of chair. Interval between injury and appearance of tumor, 2 weeks.

Case 3.—D., age 30; female. (1906.) Site of tumor, both breasts. Character of injury, pressure of aluminum corset.

Case 4.—E., age 56; female. (1907.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 5.—M., age 55; female. (1895.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 6.—G., age 68; female. (1910.) Site of tumor, left breast. Character of injury, kicked by 2-year-old child. Interval between injury and appearance of tumor, 6 months.

Case 7.—T., age 60; female. (1910.) Site of tumor, right breast. Character of injury, fall, injuring breast. Interval between injury and appearance of tumor, few weeks. Death in 2 years.

Case 8.—P., age 70; female. (1906.) Site of tumor, right breast. Character of injury, blow against iron faucet. Interval between injury and appearance of tumor, 1 month.

Case 9.—S., age 64; female. (1905.) Site of tumor, right breast. Character of injury, blow; struck against fence, bruising breast. Interval between injury and appearance of tumor, soon (few days).

Case 10.—C., age 33; female. (1895.) Site of tumor, right breast. Character of injury, blow; black and blue area. Interval between injury and appearance of tumor, effects of bruise disappeared 2 to 3 weeks later; lump.

Case 11.—D., age 33; female. (1902.) Site of tumor, double, breast. Character of injury, knocked down, striking both breasts on asphalt pavement. Interval between injury and appearance of tumor, right, 2 to 3 weeks; left, 6 months.

Case 12.—D., age 59; female. (1908.) Site of tumor, left breast.

Character of injury, blow; struck breast against heavy piece of furniture. Interval between injury and appearance of tumor, 2 months.

Case 13.—G., age 48; female. (1902.) Site of tumor, left breast. Character of injury, fall. Interval between injury and appearance of tumor, 2 to 3 months.

Case 14.—H., age 64; male. (1903.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 6 months.

Case 15.—L., age 45; female. (1903.) Site of tumor, left breast. Character of injury, blow. Interval between injury and appearance of tumor, 2 years.

Case 16.—S., age 60; female. (1903.) Site of tumor, left breast. Character of injury, severe blow by elbow of a hospital patient. Interval between injury and appearance of tumor, 2 months.

Case 17.—M., age 46; female. (1903.) Site of tumor, right breast. Character of injury, fell flat upon pavement, injuring right breast. Interval between injury and appearance of tumor, 6 months.

Case 18.—M., age 37; female. (1901.) Site of tumor, left breast. Character of injury, blow; struck by baseball (batted ball). Interval between injury and appearance of tumor, 3 to 4 days, exact site of injury.

Case 19.—M., age 46; female. (1904.) Site of tumor, left breast. Character of injury, blow from baseball (thrown ball). Interval between injury and appearance of tumor, 5 months.

Case 20.—B., age 39; female. (1907.) Site of tumor, right breast. Character of injury, ran against sharp corner of table; severe blow. Interval between injury and appearance of tumor, few days.

Case 21.—R., age 27; female. (1910.) Site of tumor, right breast. Character of injury, fell, striking right breast upon wooden chest. Interval between injury and appearance of tumor, 3 years.

Case 22.—B., age 45; female. (1904.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 23.—A., age 62; female. (1895.) Site of tumor left breast. Character of injury, fall, striking on right breast. Interval between injury and appearance of tumor, 1 year.

Case 24.—B., age 45; female. (1897.) Site of tumor, right breast. Character of injury, blow; ran against banister. Interval between injury and appearance of tumor, 1 year.

Case 25.—B., age 38; female. (1896.) Site of tumor, right breast. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 26.—B., age 49; female. (1900.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 3 years.

Case 27.—C., age 43; female. (1895.) Site of tumor, right breast. Character of injury, severe blow from tennis ball; caused fainting. Interval between injury and appearance of tumor, 1 year.

Case 28.—C., age 59; female. (1905.) Site of tumor, left breast. Character of injury, severe strain to pectoral muscle. Interval between injury and appearance of tumor, 2 years.

Case 29.—C., age 54; female. (1908.) Site of tumor, right breast. Character of injury, severe blow. Interval between injury and appearance of tumor, few months.

Case 30.—C., age 43; female. (1908.) Site of tumor, left breast. Character of injury, severe blow. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 31.—C., age 57; female. (1905.) Site of tumor, right breast. Character of injury, severe blow; struck against bedstead. Interval between injury and appearance of tumor, 2 months.

Case 32.—B., age 35; male. (1900.) Site of tumor, right breast. Character of injury, struck with baseball.

Case 33.—M., age 39; female. (1905.) Site of tumor, left breast. Character of injury, trauma from wearing bag of jewels under corset against breast. Interval between injury and appearance of tumor, 3 to 4 months.

Case 34.—M., age 50; female. (1906.) Site of tumor, right breast. Character of injury, fall; striking on right breast on table. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 35.—M., age 50; female. (1907.) Site of tumor, right breast. Character of injury, fall, striking right breast on corner of bedstead. Interval between injury and appearance of tumor, few weeks.

Case 36.—P., age 55; female. (1903.) Site of tumor, left breast. Character of injury, struck left breast against trolley car. Interval between injury and appearance of tumor, pain 1 month; tumor 2 months.

Case 37.—R., age 37; female. (1898.) Site of tumor, left breast. Character of injury, fall, striking breast against bedstead. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 38.—R., age 39; female. (1902.) Site of tumor, right breast. Character of injury, severe blow, striking breast against large nail in wall. Interval between injury and appearance of tumor, 1 year.

Case 39.—S., age 63; female. (1896.) Site of tumor, right breast. Character of injury, bruise in carrying heavy wooden pole under arm. Interval between injury and appearance of tumor, 6 months.

Case 40.—S., age 40; female. (1896.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 1½ years.

Case 41.—S., age 30; female. (1895.) Site of tumor, left breast. Character of injury, severe blow against bedstead. Interval between injury and appearance of tumor, 14 years.

Case 42.—S., age 39; female. (1899.) Site of tumor, right breast. Character of injury, blow; ran against heavy wooden object. Interval between injury and appearance of tumor, 6 months.

Case 43.—S., age 48; female. (1901.) Site of tumor, left breast. Character of injury, severe blow from bicycle. Interval between injury and appearance of tumor, 4 years; exact site.

Case 44.—S., age 36; female. (1906.) Site of tumor, right breast. Character of injury, severe blow; ran against table. Interval between injury and appearance of tumor, 5 months.

Case 45.—S., age 70; female. (1906.) Site of tumor, right breast.

Character of injury, blow; severe bruise by striking breast against bedstead iron. Interval between injury and appearance of tumor, black and blue area at once; tumor developed few days later.

Case 46.—T., age 42; female. (1895.) Site of tumor, left breast. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 47.—W., age 55; female. (1910.) Site of tumor, left breast. Character of injury, blow; struck breast against door knob. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 48.—W., age 40; female. (1907.) Site of tumor, right breast. Character of injury, fall, striking right breast against corner of wooden box. Interval between injury and appearance of tumor, severe swelling; next day all disappeared; tumor noticed exact site few weeks later.

Case 49.—W., age 30; female. (1905.) Site of tumor, left breast. Character of injury, kicked in left breast by 2-year-old child; caused black and blue area. Interval between injury and appearance of tumor, tumor 1 month later exact site of injury.

Case 50.—C., age 37; female. (1910.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 51.—S., age 54; female. (1907.) Site of tumor, left breast. Character of injury, blow; ran against sideboard; injuring left breast. Interval between injury and appearance of tumor, 9 months.

Case 52.—C., age 54; female. (1901.) Site of tumor, right breast. Character of injury, kicked by child. Interval between injury and appearance of tumor, 2 years.

The interval elapsing between the injury and the appearance of the breast tumor was as follows:

Less than 1 week.....	5	6 to 12 months.....	7
2 weeks to a month.....	14	1 to 2 years.....	5
1 to 2 months.....	3	2 to 3 years.....	3
2 to 6 months.....	8	Over 3 years.....	7

The closest connection between the effect of injury upon sarcoma and carcinoma is found in the group of tumors classed as melanotic sarcomas. Nineteen of such cases are included in my series in which the development of the tumor followed some definite injury, such as the tying off of a pigmented mole, or bruising it sufficiently to make it bleed, or burning it with a cautery.

Now this group of tumors is classed by some pathologists as sarcoma, by others, and an increasing number at the present time, as carcinoma. Certainly, in many features, like the involvement of the nearest glands, they closely resemble the carcinomatous group.

While I have not had so large an opportunity to study the relationship between trauma and carcinoma, I have made an analysis of a series of 250 cases of carcinoma which have come under my personal observation, and in which the histories were taken by myself. In this series of cases there was a history of antecedent trauma in 82, 32.8 per cent.; 120 cases were carcinoma of the breast, in 52 or 43.33 per cent., of which there was a history of a single antecedent trauma. This may seem like a very large percentage, but it is smaller than was observed at the Presbyterian Hospital by McWilliams.

Clarence A. McWilliams in the Medical and Surgical Report of the Presbyterian Hospital, on "Statistics of 100 Cases of Cancer of the Breast" (*Med. News*, April 28, 1900) observed at said hospital, states with reference to trauma as a causative factor: "In our list there is a record on this point in 65 of the patients, of which number 29, or 44.6 per cent. gave the history of a distinct antecedent trauma."

To fully explain the nature of this relationship is quite another problem than to prove that it actually exists.

Von Bergmann has no doubt that a single contusion of the muscles or glands may be the predisposing cause for all types of cancer, and his explanation that the injury produces an extravasation of blood which remains as a focus, which, later, forms a favorable nidus for the development of a cancer, is perhaps as reasonable as any that has been offered.

In my earlier paper on "The Influence of Injury upon the Development of Sarcoma" (*ANNALS OF SURGERY*, March, 1898), I offered as a possible explanation of the causative relationship of trauma to sarcoma, that: "We have only to follow out the analogy between sarcoma and tuberculosis. If we can explain how it is that tuberculous inflammations of the bones develop after an injury in children previously apparently in good health, then the same explanation could be applied to sarcoma. That such cases are by no means uncommon, has been proven by Gude, Tillman, and other surgeons. The probable explanation in these cases is that the tubercle bacilli exist latent in many individuals, and may remain harmless indefinitely under normal conditions. The trauma lowers the vitality

and, hence, the resisting power of the part injured, and the bacilli previously innocuous gain a foothold and develop. We know that we can get a suppurative periostitis from traumatism without any breaking of the continuity of the skin, and we must explain this in the same way. It is not difficult to believe that the infectious cause of sarcoma is one widely distributed and generally innocuous until some cause, *e.g.*, a trauma, places the tissues in such a condition as to furnish the proper soil for its development."

Dr. John B. Murphy in his recent paper on "The Surgery of the Joints," read before the New York Academy of Medicine (*Medical Record*, Feb. 11, 1911), states: "Virulent pneumococci were injected in dogs with a very fine needle and without producing any trauma or displacement of the endothelial cells; there resulted no response to the infection; when traumatization of the endothelium took place, however, there was a decided response."

The question of the relationship between injury and cancer has received a good deal of attention during the last three years in Europe, especially from a medicolegal point of view. One of the most important papers that has ever been written upon the subject was that of Paul Segond, Professor of Clinical Surgery of the Faculty of Medicine, France, presented before the Congress of French Surgeons in October, 1907, and discussed at great length. Segond attempted not only to determine whether or not there was a causal relationship between injury and the development of malignant tumors from the medical point of view, but he went further and discussed the problem from the medicolegal stand-point.

He said that in France, the same as in Germany and Belgium, the law is based exclusively upon a principle of indemnification which holds that every injury sustained in the course of work is subject to an indemnity, fixed in advance and varying according to the diminished capacity of the injured person for performing his work, but absolutely independent of any diseases or infirmities he might have had prior to the accident. From a legal stand-point the three following conditions must obtain:

1. It is necessary to prove that an accident occurred.
2. That there was a relation of cause and effect between the accident and the neoplasm.

3. That the accident was connected with the work in hand.

The law does not apply to professional maladies, that is, no indemnity is granted in cases in which the tumor is supposed to have been the result of *repeated slight injuries* or *prolonged irritations* connected with the particular occupation of the claimant. In other words, it must be an accident, that is to say, a "bodily lesion resulting from the action of an external and sudden cause, occurring in the course of labor." The law takes no account of anterior states or predispositions. In France, Segond states, the law concerning the accidents of labor promulgated in 1898, claims for indemnity for tumors were exceedingly few up to that time; practically all failed to receive any indemnity owing to the declaration on the part of the deponents that the tumor existed prior to the accident. He cites what he calls a very remarkable case, published by Gerné, Didier, and Jeanne of Rouen (*La Normandie Medicale*, Dec. 15, 1906), in which the causal relationship between accident and cancer was sustained by the court. This case is worth recording in brief:

Man, thirty-two years of age, in September, 1904, fell upon a rail and received localized contusions of his left knee. He remained in bed eight days and then resumed his work. Seven months later, the following February, he was obliged to stop work on account of the pain in the knee. He noticed an enlargement at about this time, which continued to increase in size. Amputation was performed by Jeanne in September, 1905, for osteosarcoma of the tibia. In October, Drs. Gerné, Didier and Jeanne were commissioned by the court of Rouen to examine the patient and to state whether the amputation became necessary as a consequence of the accident of September 20, 1904. Their conclusion was: "In the present case, it is impossible to break the chain of facts—contusion at the precise point at which later was found the maximum development of a sarcoma. A period of some months during which there seemed to be practically no result from the contusion (this latent period proves that the assumption of the pre-existence of a tumor at this point was not admissible). After this delay, pain and the progressive development of a tumor, eleven months after the accident, sufficiently developed to be recognized externally. We consider truly that one can only regard this as an example in which a sarcoma was caused by a contusion." The court accepted the opinion expressed by the experts and condemned the inter-

ested company to pay him a pension representing the incapacity resulting from the amputation.

Second states that in Germany four conditions obtain for internal cancer of supposed traumatic origin:

1. That the accident has been of a nature to provoke an internal lesion, such as a laceration or contusion of the mucous surface of the stomach or intestine, which may favor the later development of a cancer.

2. That the victim has had the appearance of perfect health before the accident.

3. That since the accident up to the time of death, the victim has had symptoms of disease proving the steady progression of the inflammation of the mucous membrane, gradually transforming the condition into cancerous disease.

4. That the autopsy has revealed the presence of a cancer in the region of the traumatism.

These conditions show how much more strongly and broadly the theory that injury may be the cause of a malignant tumor has been accepted in Germany than in France.

Second cites three cases in which the courts allowed an indemnity for intra-abdominal cancer, on the ground that it was presumably the result of an injury. One was a cancer of the stomach, following a severe contusion of the thoracic region; the second, a cancer of the stomach, resulting from a fall prone upon a boat; the tumor developed five years later; the third had a severe fall and injured the right side of the abdomen. Severe pains immediately followed (May, 1899). On June 19, the same year, a laparotomy was done and a perforated appendix and a purulent peritoneal abscess found. Three and a half years later the man died of cancer of the colon, as proved by autopsy.

Professor Thiem, who has made a careful study of the question of the influence of injury upon tumor development, was called as an expert in this case. He believed that the state of chronic inflammation, which had persisted at the site of the cæcum and the neighboring organs after operation, favored the development of a cancer, and concluded as follows: "In this sense, a relation of cause and effect between accident and the

cancerous tumor can be conceived." Conforming to this conclusion, the Imperial Office admitted the existence of a causal relationship between the accident and the death of the victim.

Segond cites other cases, which, however, I will not quote.

Assisted by Jeanbrean, Segond made a study of 61 papers, and reports on the subject of the relationship between accident and cancer. These bibliographic researches show 600 observations, 356 of which were considered by their authors as having an undoubted clinical value. He, however, believes that none of these observations is absolutely conclusive, and almost all are incomplete. They fail in part in the fundamental point, in not telling about the condition of the region injured prior to the accident, and the greater part of them are lacking in details as to the degree of the traumatic violence, the exact date of the appearance of the tumor, and its histological examination. If one were attempting a strictly scientific demonstration to which no objection could be made, on basis of these cases, one could not find in these 356 observations a single one in which the traumatic origin was beyond dispute, as in no case was there a medical examination of the parts prior to the accident, which would preclude the chronic existence of the tumor before the accident. Segond further addressed personal communications to 600 French and foreign surgeons, getting, however, only 23 replies, and states that six of these had not formed an opinion; four pronounced themselves very skeptical, while 14 expressed a more or less positive belief in the causal relationship between accident and cancer, and based the same upon series of cases which were briefly recorded.

The criticism that I made of Phelps's study of the question holds true largely in the case of Segond's more elaborate paper. They both attempt to settle the question by a study of a large number of statistics of other men, rather than by the presentation of new and original facts. They both assume—before accepting the fact of the causal relationship between injury and tumor development—that it is necessary to offer a perfect explanation of such relationship. The question of the causal relationship between trauma and cancer should be determined by a careful scientific and judicial study of all the

facts bearing on such relationship. That is a question entirely independent of our ability or inability to offer a satisfactory explanation as to the nature of such relationship.

Both Phelps and Segond make too great an effort to discredit the direct statements of intelligent patients. When a woman of more than ordinary intelligence strikes her breast against a sharp corner of a bureau, causing the characteristic signs of a local contusion (ecchymosis and tenderness), when a careful examination of the place immediately after the injury fails to reveal the presence of any tumor, but one or two or three weeks, or a month later, a hard tumor develops at exactly the point of injury, the supposed causal relationship may, with Phelps, be attributed to the "unreliability of patients' logical processes which have hypnotized the attending physician into accepting the improbable assertions as undoubted facts." But, when in the case of a fractured humerus in a man in perfect health, we have an X-ray photograph taken immediately after the fracture, as in my case, showing absolutely normal bone structure, and a few weeks later, another photograph shows a typical sarcomatous tumor, developing at the exact site of the fracture, and when subsequent operation with microscopical examination proves the correctness of the diagnosis; and again, when a surgeon makes an incision in the inguinal region for the operation for inguinal hernia, through absolutely normal structures, and four weeks later there develops at the exact site of the incision, involving all the layers of the scar, a rapidly growing round-celled sarcoma, we have facts which in no way depend upon the logical or illogical processes of patients, and which demand a more rational explanation.

Here we have a medical examination by competent surgeons immediately before the trauma or tumor development, and in a few weeks thereafter,—not an indefinite number of years, but a few weeks afterward,—we have the development of a highly malignant tumor at the exact site of the injury, and the histological structure of this tumor in every case demonstrated by microscopical examination made by competent pathologists.

My series of cases contains a large number of others

almost equally conclusive. If, then, we have even a few cases that fulfil every condition proposed by Segond and others, and which must be admitted as proving a direct causal relationship, it is perfectly logical to believe that in most other cases in which circumstances did not permit of the fulfilment of all of these conditions, especially the medical examination directly prior to the injury, the trauma played the same rôle in the tumor development.

The majority of those who admit an injury as a direct or inciting cause assume the presence of a hereditary influence or some other predisposing cause. Our knowledge of heredity is at present extremely vague, and the courts in France and Germany have refused to consider it in such cases. I will only say that in my own cases the proportion of patients with a history of cancer in some member of the family (heredity) was much smaller in the traumatic cases than in the cases in which there was no antecedent trauma.

Personally I believe (and more strongly with increasing experience) that all types of malignant tumors are of extrinsic origin. It is not improbable that what we have hitherto included under the vague term of hereditary influence may some day be proven contagion or virus, as has already been done in tuberculosis.

Whether we accept the parasitic theory of cancer, or still believe in its intrinsic origin, we must admit that trauma plays a direct and important part in the development of cancer. The argument advanced by some writers, that if such were true, all cases of trauma or a larger proportion of cases ought to be followed by cancer, is not logical. If 50 people were plunged into an icy pond and only two developed pneumonia, by this same reasoning we might say that, because 48 remained well, the shock and exposure were not causative factors in the development of the pneumonia in the two who contracted it.

The great argument advanced by Segond against the admissibility of trauma as a causative factor in malignant disease is, the absence of any definite knowledge of the condition of the parts prior to the accident. In order to have such knowl-

edge scientifically acceptable, he believes that there should be evidence of a medical examination of the locality prior to the injury, and such evidence, he states, is entirely lacking, there being no such cases.

My own series of cases supplies this deficiency in at least four instances:

1. The case of the sarcoma of the humerus; injury producing a fracture of the upper and middle third; X-ray showing absolutely normal structure of bone. Six weeks later another X-ray showing a well-developed sarcoma at the exact site of the fracture.

2. Sarcoma in the groin, starting at the exact site of a hernia incision made four weeks before.

3. Sarcoma, starting in the fascia about the external malleolus three weeks after the trauma incident to the stretching and tearing of the fascia and ligaments, due to the forcible correction of a flat-foot.

4. Sarcoma of femur, in a girl nine years of age, the daughter of a surgeon.

Phelps quotes Billroth: "In no single instance has a tumor been caused intentionally by chemical or mechanical irritation."

Yet, at the very time when Phelps's paper was being published, Clunet of Paris was actually producing a malignant tumor in a rat, experimentally, by the irritation of the X-rays. Clunet subjected a certain definite area in the rat to periodical and prolonged exposures to powerful X-rays, allowing the ulceration to heal before the next irradiation. At the end of five months, the ulcerated surface, instead of entirely healing, became greatly thickened and soon developed into a malignant tumor which killed the animal. Furthermore, the large number of cases of cancer (epithelioma or carcinoma) of the hand, in X-ray workers, directly disprove Billroth's statement. The fact that they were not produced intentionally none the less prevents us from classing them as caused by mechanical or chemical irritation.

Phelps states that, "these tumors (examples of acute traumatic malignancy) in the great majority of cases, if not in all, are sarcomata, as were both of Billroth's and two of Coley's."

The statement as regards my own cases is extremely misleading, inasmuch as the subject of the paper from which the cases here quoted were taken was "The Influence of Injury upon the Development of Sarcoma." The paper dealt with sarcoma alone, simply referring to two striking examples of acute traumatic malignancy in carcinoma, without giving any analysis or even the number of cases of trauma associated with carcinoma, of which I had a large number even at that time. That just as striking examples of acute traumatic malignancy occur in carcinoma as in sarcoma, a glance at my series of cases will show.

Cases I to V fulfil the conditions laid down by Segond.

CASE I.—*Sarcoma of the humerus.*

Mr. L., thirty-five years of age. No history of cancer in the family; a man of splendid physique, 6 ft. tall, weighing 180 pounds. Early in January he fell and received a spiral fracture of the left humerus at about the junction of the middle and upper thirds. He was treated at the Hudson Street Hospital, and then returned to Baltimore, where he was treated by Dr. W. A. Fisher. An X-ray taken at this time showed a spiral fracture without any trace whatever of a new growth. Two to three weeks later he began to have severe pain at the site of the fracture. Another X-ray photograph was taken, showing that in the meantime there had developed a well-marked tumor, apparently a sarcoma, involving both the central portion and the periosteum. The growth increased rapidly in size, and was accompanied by very severe and constant pain.

In June, 1910, an exploratory operation was performed by Dr. J. M. T. Finney, of Baltimore, who found a large sarcomatous growth, involving both the central and periosteal portion of the humerus and extending from about the junction of the middle and upper thirds nearly to the head of the bone. The bone was completely destroyed; a pathological fracture had occurred and there was a flail joint. The central portion of the tumor was curetted; in Dr. Finney's opinion amputation offered no hope of a cure.

A few days later the patient came to me for the treatment with the mixed toxins. The treatment was begun on June 16, 1910, and continued in small doses, most of them being given

systematically, in the pectoral region and a few in the arm. There was slow but steady decrease in the size of the tumor and immediate cessation of the pain, which had been constant from the first appearance of the tumor. The shell of bone about the tumor, which had undergone spontaneous fracture, gradually became harder with the formation of new bone, and within a few weeks complete union had occurred. The large cavity gradually filled up with granulations. Several curettements showed the material to be sarcoma of the same type as the original tumor, namely, spindle-celled. The pathological examinations were made by J. C. Bloodgood of Johns Hopkins and also by James Ewing, Professor of Pathology at Cornell University Medical School.

Another X-ray examination in the latter part of 1910 showed that the new growth had apparently entirely disappeared and there was firm union of the arm. The patient's general condition was excellent. In November, the granulations began to increase again in size and in spite of curetting quickly recurred. An X-ray taken in December showed a small shadow starting in the periosteum, in the axillary region, and I finally decided, early in January, to do a shoulder-joint amputation. This was performed at once and the patient is at present well.

The case is here given somewhat in detail for the reason that all the conditions necessary to establish a direct causal relationship between the injury and the development of the growth are present.

CASE II.—Unique case of sarcoma of jaw and groin, having important bearing on the relationship of trauma in the development of sarcoma.

J. R., male, six years old, was admitted to my service at the Hospital for Ruptured and Crippled, Feb. 20, 1910, as a simple case of left inguinal hernia. The family history was good, and he was operated upon by the house surgeon for an uncomplicated left inguinal hernia. The wound healed by primary union, and he was discharged at the end of three weeks in perfect condition. April 15, he was re-admitted (Dr. Wm. A. Downes) to the hospital, for a large swelling in the inguinal region, directly under the hernial incision, extending from the anterior superior spine to the upper scrotum, not involving the testicle. The swelling was entirely painless and was first noticed a week before by the

family physician, who had been called in for what was supposed to be an ulcerated tooth, who on examining the patient detected this swelling in the region of the hernial scar. He had been a week before to the Presbyterian Hospital Dispensary on account of the supposed ulcerated tooth in the left upper jaw, just mentioned. He was sent to another hospital where they have a dental surgeon who removed two teeth and sent him home.

Physical examination, April 17, 1910, showed the right upper jaw markedly enlarged, the enlargement being in the alveolar process and not in the antrum; two teeth were absent and two or three others quite loose, but the whole structure was perfectly typical of sarcoma, which diagnosis I positively made. Examination of the inguinal region showed a fusiform sausage-shaped swelling, about $4\frac{1}{2}$ inches long, extending from the left of the anterior superior spine down to the upper scrotum, the most protuberant portion being directly under the recent scar of the hernia wound. The skin was movable and not discolored; the swelling was non-fluctuating, without any tenderness, and exactly like a sarcoma in consistence rather than a hæmatoma or cellulitis which diagnoses had been made by some of the surgeons who had seen him.

I made an incision along the line of the cicatrix about $3\frac{1}{2}$ inches long, and immediately on going through the skin came down upon a structure which was absolutely characteristic of sarcoma, firm in consistence, whitish in appearance, slightly vascular, involving the subcutaneous fatty tissue and extending down to the internal oblique muscle beneath, apparently originating in the fascia of the external oblique, along the line of the incision; it extended the entire length of the incision and into the upper scrotum. I removed a considerable portion of it for microscopical examination, but the wide extent of infiltration made a radical removal quite impossible. After closing the wound, I then removed as far as possible, by curette and scissors, the tumor of the upper jaw, which was about the size of a small English walnut. It did not extend into the antrum, but involved the entire alveolar process, nearly to the antrum. This structure also was quite typical of sarcoma. One-half of the portions removed was sent to Dr. Jeffries, Pathologist of the Hospital for Ruptured and Crippled, who pronounced both small round-celled sarcoma; the other half of the portions removed was sent to Dr.

Ewing of Cornell University Medical School Laboratory, who reported as follows:

"May 24, 1910: Tumor of jaw, is a complex tumor very difficult to diagnose and badly crushed, so that the relations are impossible to reconstruct. I find in it areas of fibrous tissue, eroded bone, spaces lined by cylindrical epithelium, areas of tissue invaded by this epithelium as in embryonal carcinoma, and finally larger areas of malignant tumor tissue in which the cells are large, polyhedral, and densely staining. This is evidently a complex tumor, and the presence of epithelium lined spaces and dense fibrous tissue suggest that it arose from a remnant of a tooth follicle or from the epithelium of the antrum. Without an accurate statement of the parts of the jaw involved, it is impossible to give any report on the nature of the jaw tumor, but it seems quite possible that it is the same sort of a tumor as the growth in the groin.

"The growth from the groin is a lymphosarcoma arising in the lymph-node and involving the surrounding fat tissue. Both tumors are quite malignant."

Two other specimens, one from the tumor in the inguinal region and one from the tumor in the upper jaw, were examined by Dr. F. M. Jeffries, Pathologist to the Hospital and Professor of Pathology of the New York Polyclinic Medical School and Hospital, who pronounced both small round-celled sarcoma.

This case I believe to be absolutely unique, and I think it has a very important bearing upon the part which trauma plays in the etiology of malignant tumors. It would seem possible that the sarcoma in the upper jaw was the primary growth, which, however, did not reach sufficient size to call any one's attention to it until after the operation for hernia. The trauma incident to the operation so lowered the vitality or resisting powers of the tissues in the vicinity of the wound that they furnished a favorable nidus for the secondary development of a sarcoma, the causative agent of the sarcoma, whether it be a parasite or infected cell, being carried to this locality through the blood current. These cells or parasites were probably in the circulation before the time of the local trauma, but the normal tissues had sufficient resisting power to prevent a local infection.

The patient was put immediately upon the mixed toxins of erysipelas and *Bacillus prodigiosus*, the dose being carried up

gradually to 5 mm. Before a reaction could be produced, owing to some family troubles, he was taken away from the hospital two weeks from the time of his entry. In this short time, however, the disease had advanced with great rapidity, extending up into the orbit, causing almost complete closure of the eye and also extending up into the glands of the iliac fossa, and it caused the death of patient in three months.

CASE III.—*Sarcoma of ankle, developing immediately (within two weeks) after forcible correction of flat-foot.*

F. K., male, sixteen years of age. Good family history; always well up to December, 1909, when he came to the Hospital for Ruptured and Crippled, service of Dr. W. R. Townsend, for treatment of flat-foot. At this time careful examination showed nothing whatever abnormal outside of the flat-foot. Both feet were forcibly stretched by Dr. Arthur Cilly and placed in plaster-of-Paris bandages in a position of marked adduction. At the end of two weeks the bandages were removed, and there was found a well-marked circular swelling, about $1\frac{1}{2}$ in. in diameter, situated just below the external malleolus of the right foot at a point where the greatest strain to the ligaments had occurred during the stretching. The skin was normal in appearance; the tumor moderately firm in consistence, but not bony, firmly fixed to the underlying structures, apparently not connected with the bone. I saw the case a week later in consultation with Dr. Townsend, and we both agreed that it was almost certainly sarcoma. The tumor had by this time become $2\frac{1}{2}$ in. in diameter, with an elevation of $\frac{3}{4}$ in. above the normal surface; it was firmly fixed to the ligamentous structures.

The patient was referred to my service at the General Memorial Hospital. Under ether anæsthesia I attempted to excise the tumor, but as there was no capsule, and infiltration of the surrounding tissues in all directions, it was impossible to make a complete removal. It extended down to the bone, but unquestionably originated in the ligamentous structure rather than the bone or periosteum. A good deal of the tumor had to be left behind. The patient was then put upon the mixed toxins of erysipelas and *Bacillus prodigiosus* for two or three weeks, but the tumor continued to grow in spite of treatment. Four weeks later amputation at the junction of the middle and lower thirds of the tibia was performed, and the patient again put upon the

toxins as a prophylactic, for three months. He is at present in perfect health, nine months afterwards. (March, 1911: Patient has just developed metastases in the lungs.)

This case is one of the most conclusive as a demonstration of the causative effect of a trauma in the production of malignant tumor. As Dr. Townsend stated: "Here we have an example in which a sarcoma developed under constant and minute observation immediately after a trauma, almost as if one had planted a grain of corn and watched it germinate."

CASE IV.—*Acute subperiosteal spindle- and round-celled sarcoma of femur.*

M. B., age nine years (March, 1907). Daughter of a prominent physician.

Patient always in perfect health up to 2½ weeks ago, when she fell from a bicycle. Ten days later she began to complain of pain just above right knee. Physical examination showed a small tumor apparently connected with the femur, just above the inner condyle. This grew very rapidly. Exploratory incision and microscopical examination made three days later showed it to be subperiosteal and mixed spindle- and round-celled sarcoma. I saw the patient six days after the tumor was first noticed and found a bony tumor involving the whole circumference of the lower end of the right femur; more marked on the inner side, extending up for five inches; circumference two inches more than other side. Mixed toxins were given for ten days but failed to control the rapid increase in size. Amputation within two weeks from time I saw her. Generalization within three months. Death four months from time of injury.

CASE V.—*Sarcoma of the humerus; acute traumatic malignancy.*

H. L. B., male, age ten years (March 16, 1910). Family history good.

Five weeks ago patient fell on the ice and struck on his left shoulder and upper arm. He immediately lost power of the arm and a medical examination showed a fracture about the junction of the middle and upper thirds of the left humerus. Three weeks later his doctor found a marked swelling on site of fracture, which he took to be redundant callus. This arm increased rapidly in size and at my first examination two weeks later, five months from date of injury, the whole upper portion

of the left humerus was enormously enlarged. Skin covered with greatly dilated, bluish veins. Tumor extended inwards under the pectoral muscle and backwards over to the scapula. X-ray photograph showed a typical sarcoma of the humerus at the site of a recent fracture. Two days later had an interscapular thoracic amputation. Patient made an interrupted recovery. Toxins given immediately after and kept up for five months. Patient well, March 1, 1911.

CASE VI.—*Acute traumatic malignancy; spindle-celled sarcoma of the breast.*

M. L. McL., thirty-four years old; single; in May, 1906, struck her right breast with a tooling instrument. She had a fear of cancer, and a short time after the blow began to worry about it. A week later she noticed a small swelling appearing at precisely the point of injury. The tumor could not have been present before the injury, because her anxiety with regard to the matter had made her watch it carefully in the meantime. The swelling grew very rapidly. It consisted of a movable lump attached neither to the skin nor deeper parts, and it was harder than the rest of the breast. Two months later she received three treatments with the X-ray in Paris. The tumor continued to grow rapidly and she came to New York.

I saw her in consultation with Dr. Parker Syms, July 23, 1906. Physical examination showed the entire right breast symmetrically enlarged and transformed into a large tumor double the size of the other breast. The tumor was soft and semifluctuating. She had had a temperature of 102° for three or four weeks prior to this time. A portion of the tumor was removed for microscopical examination, which proved it to be spindle-celled sarcoma. There were no enlarged glands. The breast was entirely removed and the axilla carefully cleaned out by Dr. Syms, and shortly afterwards the mixed toxins were administered under my direction, for a number of months. In spite of this a recurrence took place about a year later, and she died within 15 months after operation.

The following case of carcinoma is nearly if not quite as convincing, as there is little chance of the man having had a tumor of the face before the injury, and not noticed by himself or his friends.

CASE VII.—*Carcinoma of the face; acute traumatic malignancy.*

L. F., male, forty-nine years of age, was referred to me on June 5, 1908, by Dr. C. A. Bleiler. There was no family history of cancer. The patient had been in perfect health up to May, 1908, when he was struck over the right malar region by a strong lever while at work on a train (he was a railroad employé). A swelling developed immediately after the blow; he consulted a physician the same day. The following morning poultices were applied and these were continued for two weeks. The swelling continued to gradually increase in size, and finally became ulcerated over its central portion. Physical examination on June 5, 1908 (a little over three weeks after the injury), shows the patient about forty-five years of age, of strong physique and perfect general health. On the right side of the face in the malar region is a tumor the size of a goose egg, movable upon the deep parts, apparently originating in the muscle and fascia. The skin is very much reddened, and in the centre there is an ulcerated area about $1\frac{1}{2}$ in. in diameter; free hemorrhage on removal of the dressing; no enlarged glands.

Although the case seemed nearly inoperable, I intended to remove the growth, if possible, and operated the following day. It was impossible to remove the entire tumor and a portion had to be left behind. The patient was immediately put upon the mixed toxins. In July the remaining portion of the tumor could be removed by my associate, Dr. Downes. In spite of these operations and the toxin treatment, the tumor very quickly recurred and the patient's general health soon became affected. The treatment was discontinued. The disease progressed with great rapidity and caused death within three months from the time of the injury. Microscopical examination was made by W. C. Clark, Pathologist to the General Memorial Hospital, and by James Ewing, Professor of Pathology at Cornell University Medical School, who pronounced the disease carcinoma.

The following case of Schöppler's also fulfils every condition laid down by Segond and Phelps.

Schöppler (*Zeitschr. f. Krebsforschung*, Bd. x, Hft. 2, 1911) reports a case of carcinoma of the breast, following a single trauma in a previously healthy woman who had been examined by him a few days before the injury. Schöppler

states that while there are those who, in the case of a supposedly traumatic cancer would go so far as to refuse to accept as convincing any statement regarding the previous health of the parts in question, except such previously healthy condition has been proven by the *microscope*, he believes that a preceding *clinical* examination of the parts involved ought to be sufficient to justify one in excluding a pre-existing diseased condition of the tissues. It is this latter condition that has been fulfilled in the case observed by himself:

The patient, a woman thirty-six years of age, who had always enjoyed perfect health, came to him in the first days of March, 1909, believing herself to be pregnant. He made a thorough examination and found no pathological changes present. On March 10, this woman fell down-stairs, injuring her left breast. The resulting pain in the breast was so severe that she called in Dr. Schöppler the next day. He found in the outer portion of the left breast a sensitive, slightly ecchymotic area. In a week's time the sensitiveness and suggilation had disappeared. End of April Schöppler was again called to see the patient who had been noticing a hard swelling to appear at the exact site of the injury, which had by this time reached the size of a hazel-nut. Operation advised by Dr. Schöppler was refused by the patient. The tumor continued to grow rapidly, and by the end of May had reached the size of an apple. She then consented to removal of the tumor. The pathologist pronounced the growth an intracanalicular sarcoma. Examination end of July showed no trace of a tumor, but by the middle of August, two tumors began to develop in the glandular tissues near the scar and by the beginning of September extended over the entire breast. Amputation of the latter was done and microscopical examination proved it carcinoma simplex of the left breast.

Dr. C. B. Lockwood, in a lecture delivered at St. Bartholomew's Hospital on June 8, 1910 (*The Lancet*, Aug. 13, 1910, p. 445), on "Fibroma, Sarcoma, and Fibromyoma of the Abdominal Wall," stated in connection with the information volunteered by one of his patients, that she had received a severe blow at the site of the tumor two years before: "I do not think it is right altogether to ignore this history of a blow or an injury. An injury results usually in the extravasation of blood. Extravasation of blood brings about inflammation, and inflammation brings about tissue changes, and these tissue changes may bring about cell multiplication, and this cell multiplication may run wild and result in the forma-

tion of a tumor. I cannot help believing that in the breast a blow is sometimes the preliminary to the formation of carcinoma, because a blow results in the extravasation of blood; an extravasation of blood inflames the breast tissue, and the result is a chronic mastitis. The epithelium of the acini or of the ducts proliferates, just as the epithelium of the tongue does, and goes into the lymph spaces and onward into the lymphatic glands. Seen at that stage, you would say that the patient had carcinoma of the breast. It is conceivable to me that a similar course of events might lead to the proliferation of the connective-tissue cells of the abdominal wall and to the production of a fibroma, or even of a sarcoma. There is no evidence that these tumors are ever due to anything introduced into the body. But again, I would not draw too wide inferences from the absence of evidence on this point. Certainly, things introduced into the body can produce tumors of considerable size. The *Spirochæta pallida* introduced into the body can cause gummata, which have over and over again been mistaken for sarcomata. So that if any of you attempts to investigate the production of sarcomata, you should not, I venture to suggest, ignore those possibilities."

The recent experiments of Carrel, part of which have been briefly published recently, for the first time showing that human sarcoma cells can be made to grow outside of the human body, throw some light on this vexed question. Such cells grow only under the most favorable environment, the very slightest infection immediately inhibiting their growth, and the patient's own blood plasma being the medium upon which they thrive best. It is not difficult to understand that an injury, and even an insignificant injury, by producing a slight extravasation of blood may cause just the culture medium for the abnormal growth of the cells.

(To be Continued)

**THE ABDUCTION TREATMENT OF FRACTURE OF
THE NECK OF THE FEMUR, WITH ESPECIAL
REFERENCE TO THE ADVANTAGES OF THE
SEMIRECLINING POSTURE AND CHANGES OF
ATTITUDE IN ITS APPLICATION TO ELDERLY
SUBJECTS.**

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A WOMAN, seventy-three years of age, was seen on December 13, 1909. Three days before she had been thrown down by a street car and had been taken to a hospital, where a diagnosis of fracture of the neck of the femur was confirmed by an X-ray picture. After removal to her home the long side splint which had been applied at the hospital was replaced by sand bags; in the opinion of her physician, an equally efficient and less burdensome support.

The patient presented the distortion and helplessness of the limb characteristic of fracture of the neck of the femur, with a displacement of the fragments indicated by one and a half inches of shortening. As she was the mother of a physician, the question of treatment was particularly embarrassing to an advocate of an unorthodox method. The advice of the other consultants followed the accepted teaching, that treatment was hazardous and that even if it were efficient, union was very improbable.

On the other hand, some support was required because of pain on movement, and if this might hold the fractured surfaces in contact one might at least hope for repair as contrasted with certain disability, a moral support both to the surgeon and to the patient that is not generally appreciated. It was decided therefore to apply the abduction treatment.

Although this has been described many times, neither its principles nor its details are clear even to some of those who criticize it, and I shall take this opportunity, therefore, to again explain them.

It is essential for restoration of function that deformity be reduced, and for union that the fractured surfaces be fixed in contact. As one has no control over the inner fragment, contact can be assured only by adapting the outer fragment to it. To accomplish this the patient must be anæsthetized. The shortening is then reduced by direct traction, the thigh having been lifted to the proper plane. It is then abducted to the normal limit (Fig. 1).

1. Abduction turns the fractured surface of the neck downward to meet that of the head.

2. Abduction makes the capsule tense and aligns the fragments.

3. Abduction relaxes the muscles whose contraction tends to displace the fragments.

4. Abduction apposes the trochanter to the side of the pelvis, or, if the fracture is near the head, engages the extremity of the neck beneath the rim of the acetabulum and thus provides a mechanical check to displacement.

5. In what are classed as successful results of treatment by routine methods, in the sense that union has been obtained, there is almost invariably limitation of abduction to a degree sufficient to cause disability. This depends primarily upon unreduced deformity, but it is increased by the muscular adaptation to the median position in which the limb has been fixed during treatment. Fixation in the attitude of full abduction assures, therefore, the conditions most favorable to functional recovery.

What is classed as impacted fracture is, usually, a complete fracture with but slight displacement. In most instances, whether the fragments are adherent or not, the essential deformity is a loss of the upward inclination of the neck upon which the range of abduction (45 to 55 degrees) depends. For the anatomical limit of abduction under normal conditions is reached when the neck, approximately in the horizontal plane, comes into contact with the upper surface of the acetabulum.

The range of abduction, therefore, is limited, in degree corresponding with the lessened angle (coxa vara), and this

limitation is still further increased by muscular adaptation. Functional disability is thus inevitable unless a sufficient angle is restored.

Correction of deformity is usually described as the "breaking up" of an impaction, apparently a violent manipulation designed to separate firmly adherent fragments. Once separated, repair is doubtful because apposition cannot be assured by the means usually employed. Under such conditions the advice, that contact shall not be disturbed, is sound. The abduction method, however, enables one to correct the deformity to the degree that is practicable, without danger.

The patient having been anæsthetized is placed on the pelvic rest, the limbs being supported in the manner to be described. The shortening is then reduced by direct manual traction, aided by pressure on the projecting trochanter, the limb being rotated inward so that the position of the foot corresponds to its fellow. It is then slowly abducted under traction to the desired degree, preferably to the normal limit.

In most instances no force whatever is required, in others, particularly in the class seen in early life, in which the fracture is incomplete, the deformed neck coming into contact with the upper border of the acetabulum is fixed, and one may, by means of the leverage of the extended limb and the fulcrum furnished by the rim of the acetabulum at the seat of the injury, on further abduction restore the normal relation between the shaft and the neck.

In the ordinary type of the epiphyseal fracture the neck is displaced upward and forward in its relation to the head and is often adherent to it. Thus forcible and repeated abduction and inward rotation may be required to disengage and replace the fragments, failing in which an open operation is indicated as described in previous papers.

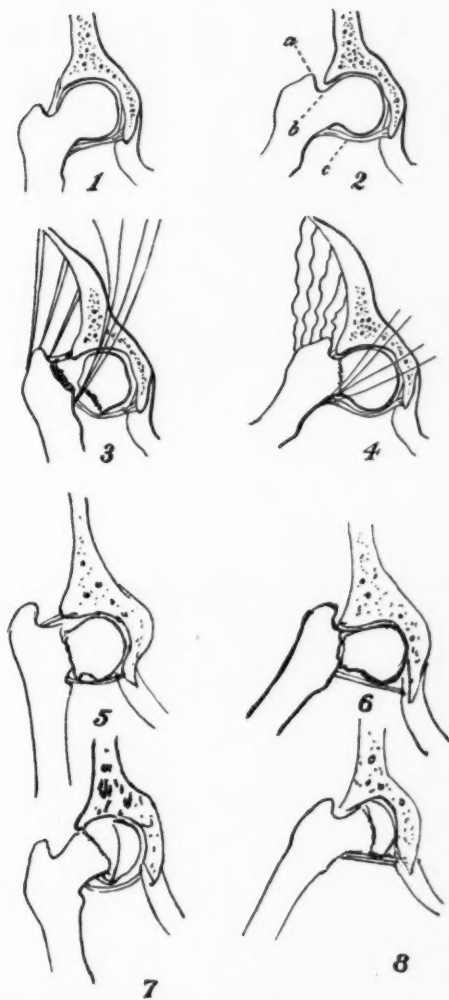
The application of the abduction treatment in the case under consideration was in detail as follows: Seamless shirting was first fitted to the body and limb to permit the use of friction bandages, two of which were inserted. The patient having been anæsthetized was lifted carefully to a table, the shoulders resting on

a box, the pelvis on a firm sacral support, the two limbs being held in the extended position by assistants. The assistant supporting the sound limb then abducted it to the full limit (about 45 degrees), reached when the upper border of the neck and the inner surface of the trochanter came into contact with the rim of the acetabulum. The operator then flexed the thigh on the injured side and rotated it inward, with the aim of disengaging the fragments from the capsule. It was then extended and supported from beneath while the assistant, applying steady traction, easily drew the trochanter down to its normal relation with Nélaton's line and to the anterior superior spine. It was then abducted to the full limit, the sound limb serving as a model both as to rotation and abduction. Final inspection showed the anterior spines in the same plane, the limbs symmetrical in equal abduction and of equal length by measurement. In this attitude the body is easily balanced on the sacral support by the widely separated and extended limbs, and a very moderate degree of traction aided by the tension on the capsule and the pressure of the trochanter on the lateral tissues of the pelvis will prevent displacement.

In cases of recent fracture the shortening is very easily reduced in the manner described, the pelvis being fixed by the hands of the operator. If there is more resistance, a folded sheet is passed between the limbs and an assistant, standing by the anæsthetist on the injured side, holding the two ends provides countertraction. The only essential apparatus is a firm pelvic rest, that shown in the photograph being the best. An efficient support may be cut from strong sheet steel, the sacral part approximately the size and shape of a hand, with a base bent to the same plane and screwed to a board (Fig. 2).

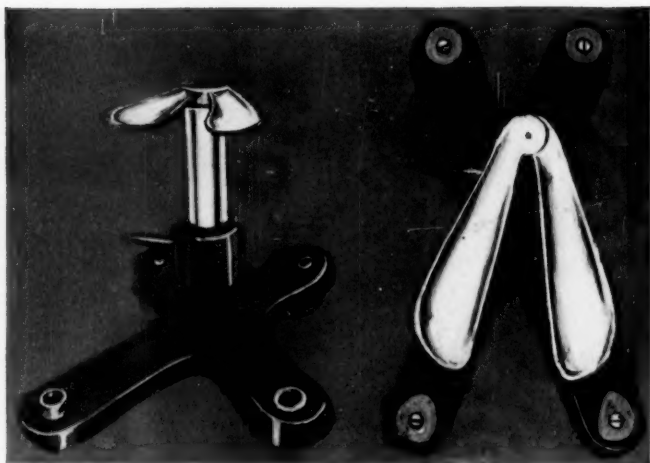
The body and limb were firmly and smoothly covered with sheet wadding and cotton flannel bandages, all bony points being carefully protected. A long plaster spica support was then applied from the toes to the axillary line, accurately moulded about the trochanter, enclosing and supporting the entire buttock, and strengthened beneath the hip by a band of steel of the size and shape of the Thomas hip splint. The entire procedure was completed in half an hour. The anæsthetic caused no disturbance and the support no especial discomfort. The following day and at intervals thereafter the patient was turned completely over upon her face to relieve the back, care being taken to hold the

FIG. 1.



Diagrams to illustrate the text. 1, the normal hip-joint. 2, The anatomical checks to abduction; *a*, impact of the trochanter and the ilium (muscles intervening); *b*, contact of the neck with the rim of the acetabulum; *c*, tension of the capsule. 3, the deformity of complete fracture and the influence of muscular contraction. 4, reposition by traction and abduction, showing muscular relaxation and changed direction. 5, incomplete and impacted fracture illustrating coxa vara deformity. 6, reduction of deformity by abduction. 7, 8, epiphyseal fracture and separation with reduction.

FIG. 2.



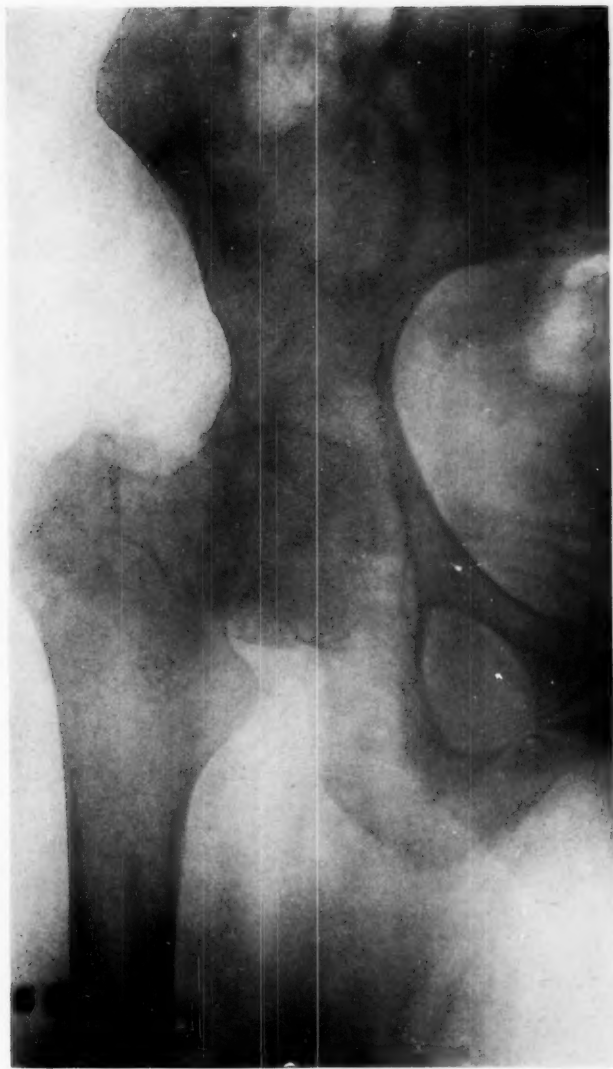
Schultze's pelvic rest.

FIG. 3.



The elevation of the head of the bed (25°) to provide a semi-reclining posture and thus to lessen the danger of thoracic congestion and to improve the nutrition of the injured part.

FIG. 4.



X-ray picture, six months after the accident, shows the process of repair. The fracture is of the intracapsular type in which bone absorption and non-union are, it is taught, practically inevitable in patients of advanced years.

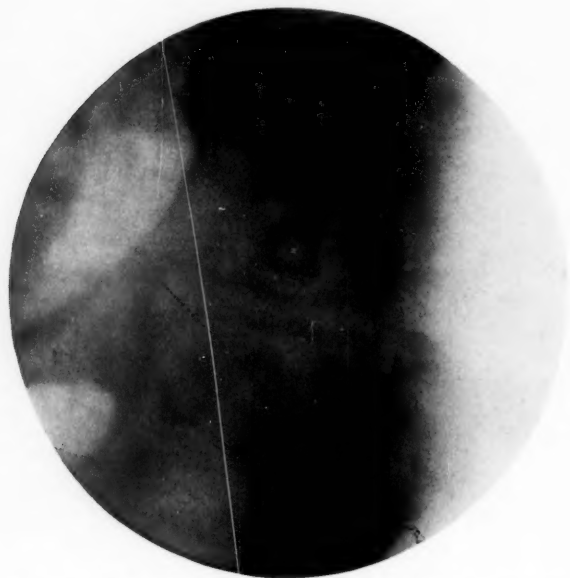
FIG. 5.



A series of pictures (5-9 inclusive) illustrating the treatment of fracture of the neck of the femur.

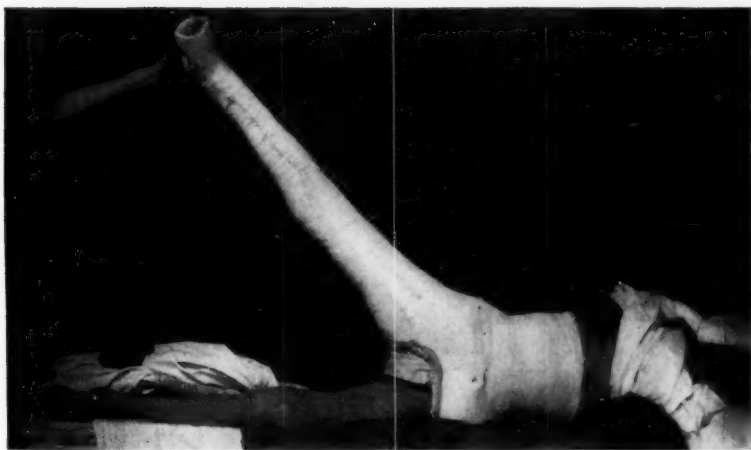
This figure shows the deformity of complete fracture. The patient, a girl 14 years of age, was first seen in August, 1910, three weeks after the injury, a fall from a swing.

FIG. 6.



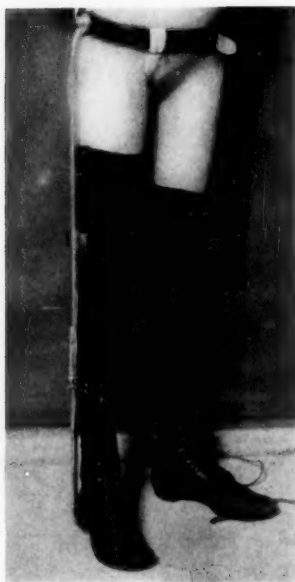
X-ray taken six months later, showing reduction of the deformity.

FIG. 7.



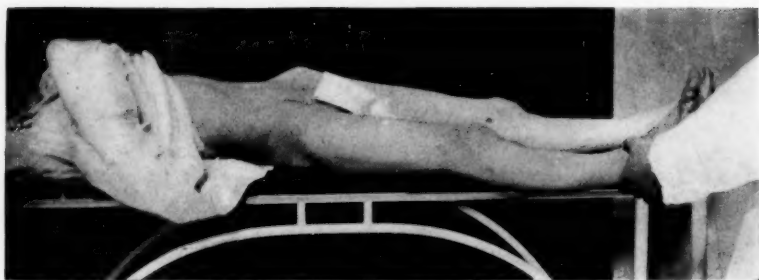
The plaster spica holding the limb at the limit of normal abduction, illustrating the adjustment to the pelvis and to the hip.

FIG. 8.



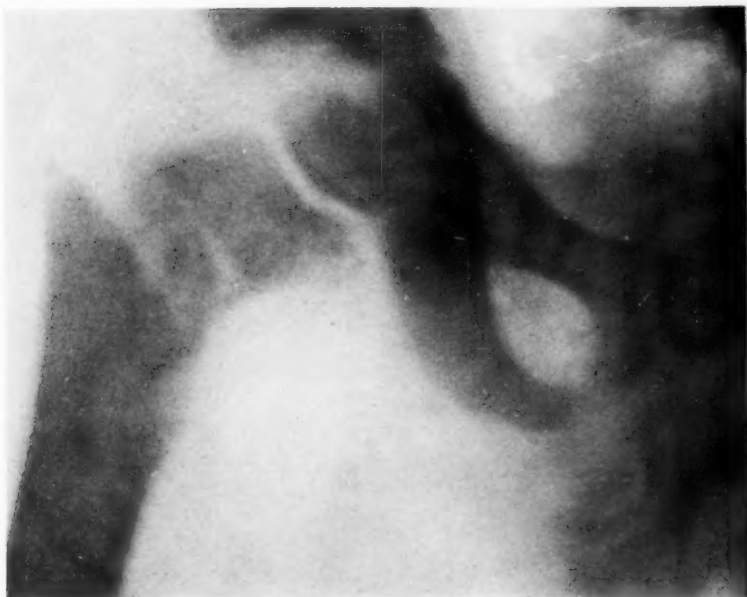
The traction (caliper) hip-brace used as a protective apparatus. The upright is so adjusted by means of the key that no weight falls upon the heel.

FIG. 9.



Illustrating the most important detail in the after-treatment, drawing the limb outward to the attitude in which it had been fixed by the plaster spica. This patient was examined on March 16, 1911. A perfect functional cure has been attained.

FIG. 10.



Fracture at the base of the neck in a child 3 years of age. Seen in August, 1910. Treated with perfect success by the abduction method. In untreated cases of this class the deformity is increased by functional use.

limb in its exact degree of abduction, so that the upper part of the support might not press uncomfortably on the thorax.

As the particular danger of treatment of elderly subjects is said to be hypostatic pneumonia, the head of the bed was raised as shown in the photograph (Fig. 3), the height varying with comfort of the patient, that illustrated being from 20 to 25 degrees or one-quarter the distance from the horizontal to the perpendicular. At this inclination the patient sometimes complained of discomfort in the hip and tension in the limb caused by "rush of blood." Thus the elevation of the head of the bed provided a semireclining posture with its obvious advantages, and at the same time assured congestion which should favor repair, as contrasted with the elevation of the foot of the bed required when traction is employed.

The patient was, for her own satisfaction, supported in the upright position during the fourth week. The upper half of the spica was removed in eight weeks, leaving the lower section as a support for a week or more longer. The limbs were then of equal length by measurement. There was no local deformity.

The accompanying X-ray picture (Fig. 4) taken six months after the injury shows the seat of the fracture in process of repair and the comparative symmetry attained. At the present time there is no deformity, no shortening, practically no limitation of motion, and the patient walks with a cane with but slight limp.

The after-treatment of fracture of the neck of the femur is only secondary in importance to the reduction of the deformity. Repair must be slow and functional recovery is delayed by the involvement of the joint in the injury and in the process of repair (Fig. 5). Furthermore the neck of the femur is exposed to much greater strain than are other bones, and the early use of the limb to which patients are encouraged, particularly when the fracture is thought to be impacted, increases the direct deformity and thus further deranges the mechanism of the joint. This, together with the nutritive changes following the injury, are the chief causes of the local distortions classed as traumatic arthritis deformans.

A more common cause of unnecessary disability is adduction of the limb, often combined with flexion. This is in-

duced primarily by unreduced deformity, but it is exaggerated by voluntary and involuntary adaptation to the weak, disorganized, and sensitive articulation. Weight should not be supported directly for at least six months, nor until voluntary and passive movements are relatively free and painless (Fig. 8).

By far the most important manipulation in the after-treatment is to draw the limb out to the position of abduction in which it was originally fixed several times during the day. This should be begun immediately after the spica is removed, and continued until the patient has regained the ability to place it in the desired attitude. If this is neglected, the range of abduction lessens very rapidly, the attitude of adduction and flexion being, as has been stated, the natural adaptation to weakness and discomfort (Fig. 9). This emphasizes the disadvantage of fixing the limb for many weeks in the median line as in the routine methods of treatment, since muscular retraction is in itself a very important factor in increasing the disability generally supposed to be inevitable after this injury.

If the range of abduction of the extended limb can be preserved, which implies of course primary reduction of deformity, the other movements will be regained without especial effort. This is of importance, since the ordinary attendant may be taught to draw the limb outward to the attitude which the plaster support has made familiar, whereas the manipulations required to overcome muscular retraction and the like require more skill and experience than are usually at the command of patients of this class. This calls attention again to what has been tabulated as the fifth advantage of the abduction method.

In the numerous papers that I have written on this subject, the argument has been confined thus far to the technical treatment of the injury, by the exclusion of all cases in which the physical condition of the patient might prevent or modify the treatment of the fracture as a fracture. The purpose has been to present a direct contrast to the accepted teaching in which the obstacles to success are exaggerated by mislead-

ing statistics and by questionable inferences. For example, fracture of the neck of the femur caused by slight or indirect injury is classed as peculiar to old age and is explained by local atrophy, while fracture in the vigorous subject is supposed to be caused usually by direct violence that injures the bone beyond the possibility of repair. In old age, impaired nutrition makes repair doubtful. In middle life, crushing of the bone prevents restoration of function, while the fracture in youthful subjects is ignored.

As a matter of fact, however, the neck of the femur is mechanically a weak point in the skeleton. Under the general atrophy incidental to age, the weak point becomes relatively weaker and more liable to injury because of insecurity of the gait. But, as has been stated, it has always been weak, and therefore it may be broken at any age by slight force advantageously applied, a particularly susceptible period being adolescence.

In the elderly subjects, the character of the injury is unmistakable. The favorable class, however, because of failure of diagnosis and for other reasons, is inadequately represented in the hospitals where official statistics are compiled. The aged and feeble are unfavorable subjects for any treatment, particularly so for that of this fracture. Yet this class has set the standard, which is only varied as to quantity when applied to the vigorous patient. Its application is essentially perfunctory, and the disregard of surgical principles from beginning to end is a sufficient explanation of the disability supposed to be inevitable after this fracture.¹

Under questionable inferences, as applied at least to the class of cases suitable for treatment, may be included inability for repair because of the effect of age on the blood supply, supposed to be furnished by the ligamentum teres, the spon-

¹"Our prognosis in cases of fracture of the neck of the femur must always be unfavorable. In many instances the injury soon proves fatal, and in all the functions of the limb are forever impaired; no matter whether the fracture has taken place within or external to the capsule, whether it is united by ligament or bone, shortening of the limb and lameness are the inevitable results."—R. Smith.

taneous absorption of bone, and the effect of the synovial fluid in preventing union.

What is certain of this fracture may be summarized as follows: Of all injuries of this class it is by far the most difficult to treat: because of the physical condition of a large proportion of the patients; because of the situation of the injury, which necessitates constraint of the body as well as of the limb; because of the shape, position, and relation of the fragments which make apposition difficult to secure and to maintain; because nutrition is feeble. Thus repair is dependent upon accurate adjustment and it requires many months for its accomplishment. Whether the proportion of cases in which failure is inevitable, although every condition for success has been fulfilled, be large or small, is purely conjectural because these conditions have never been assured.

The observation of deformity, disability, and non-union following fracture of the neck of the femur in youthful subjects long since convinced me that these were essentially penalties for inefficient treatment, since there could be no question of the inherent capacity of the tissues for repair. It was in this officially non-existent class that the abduction method was tested before applying it to older subjects. Its relative efficiency as a means of correcting deformity, in apposing and fixing the fragments, and its practicability as a basic treatment for all types of the injury have since been demonstrated in many cases, by direct observation at open operation, by X-ray pictures, and by functional cures that have been attained by others as well as by myself.

Now for the first time the application of the abduction method in the treatment of elderly patients, who are considered proper subjects for local treatment, is advocated, since it would appear that it is not only the most effective, but, because of the changes of posture that it permits, the least dangerous of methods. In each case of this class the treatment must be considered as an experiment, to be continued or abandoned according to the indications, and, in the absence of reliable evidence, one is justified in at least hoping for repair.

Fracture of the neck of the femur if for no other reason than the time required for treatment is out of place in a hospital ward. Fortunately the abduction method is well adapted to private practice, for although the procedure is somewhat of the nature of an operation, once applied, constant and skilled attention is not essential to success.

The abduction treatment represents a new point of view,² namely, that the proportion of cases in which efficient treatment is practicable has been grossly underestimated; that the results in this, as in other fractures involving joints, depend primarily on the restoration of normal contour, and that the reduction of deformity is not only essential to functional recovery, which should be the aim in treatment, but that it offers the best, and in complete fracture, the only, assurance of union.

The method which enables one to apply these principles has received its distinctive name because of the means employed to reduce deformity and from the attitude in which the limb is fixed after this is accomplished. It is not properly classed as a "plaster-of-Paris" treatment, since braces or traction even might be used to assure the position.³ The plaster spica is, however, the only support generally available. If properly applied, it is more efficient and more comfortable than routine methods, of which the bed is the essential part of the apparatus and in which unrelieved rest upon the back is required. If the direct restraint of the spica is greater, it is more than compensated by the freedom from discomfort on movement, and by the relief assured by the changes in attitude that it permits. It is therefore, contrary to the prevailing opinion, the most efficient preventive of pressure sores.

The abduction method should be used with discrimination,

²"The attainment of the ideal object of treatment, restoration of form and function, is rarely to be expected or even sought. . . . The first indication is to save life, the second to get union, the third to correct or diminish displacements."—L. A. Stimson.

³Robert Jones uses a modification of the double Thomas hip splint for this purpose. Proceedings of the Royal Society of Medicine, December, 1910.

both as to the selection of suitable cases and in adaptation to the local conditions. It is perhaps needless to say that the comfort of the patient and the effectiveness of the treatment are dependent in great degree upon the proper adjustment of the support. Although experience, therefore, is as desirable in this as in other surgical procedures, it would seem that an intelligent novice might apply a treatment whose objects are definite and whose effects are demonstrable, with better prospect of success than more familiar methods in which no attempt is made to assure the primary essentials for union, and which have been so discredited by practical experience that a large proportion of the patients receive no treatment whatever.

The purpose of this paper is to call attention to the advantage of elevating the head of the bed, which by increasing the blood supply of the lower extremities should on the one hand favor repair, and on the other, lessen the danger of thoracic congestion. This advantage of the abduction method may increase its availability in the treatment of the less favorable class of cases.

The details of method have been reviewed for the benefit of those who may be dependent upon the inadequate and incorrect descriptions that appear in the text-books and in special treatises on the subject.

FRACTURES OF THE SHAFT OF THE FEMUR WITH MARKED DISPLACEMENT.*

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It would appear that fractures of the shaft of the femur have not received the careful attention and study which they merit, perhaps because it is rare that a surgeon in active professional life sustains an injury to this bone, with the possible exception of those who ride horseback, or, again, it may occur as the result of an automobile or railroad accident.

Much time and consideration have been given to the study of enlarged prostate, appendicitis, and like pathological conditions, to any of which all classes and professions are liable. And, with these commoner affections constantly in mind, it is little wonder that the femur should not, of late years, have received the attention which it really deserves.

Fracture of the shaft of the femur is not, on the whole, a very common injury, and our experience in its repair is almost entirely confined to our hospital practice rather than in our private surgical work. Of course, it must be understood that we are dealing with fractures of the shaft of the bone occurring in the active years of life and not with fractures of the neck of the thigh, which occur so commonly in persons past the meridian.

The question now to be considered, in a measure, after an accident of this description is: *Is the limb after treatment in as good condition and position as it was before the accident, following what is accepted as good results?*

It is the generally accepted opinion that from one-half to one inch shortening of the limb is a fairly satisfactory result,

* Read before the Philadelphia Academy of Surgery, December 5, 1910.

but with this we shall often find considerable rotary displacement and angularity, which, if low down, frequently interferes with the function of the knee-joint, due to an excess of callus, which can be readily felt at the seat of injury.

A careful study of the museum specimens of this injury is very instructive and is calculated to modify one's previous conception of what actually takes place and what constitutes a good result.

I think the general belief among many surgeons (who should know better) is, that with general anæsthesia, it is quite possible in a transverse fracture to get good end-to-end apposition of the fragments and keep them in perfect position by means of weights and pulleys, sand bags, etc., and that a nice, spindle-shaped lump of callus will surround and hold the ends of the broken bone together, and that the leg will be as good as ever after the injury.

It may seem a homely comparison, but no person of reasonable intelligence would say that the broken leg of a piece of furniture is as good or as perfect, no matter how well repaired, as it was before being broken. And the same analogy holds good as regards the femur that has been fractured.

Let us consider for a moment some of the actual conditions which confront us, as illustrated by an X-ray photograph or any selected museum specimen.

And here a word of caution must be offered in regard to the way in which the X-ray photograph is prepared. If the tube is not directly over the seat of fracture, the deformity may be enormously exaggerated, and it is always well to have the picture taken from several points of view, as an incredible amount of misinformation may be derived from the study of only one picture.

There is always varying degree of deformity, due to overlapping of the fragments.

The lower fragment may be either in front or behind, inside or outside the upper fragment, but is never exactly where it should be, if absolutely accurate reduction of the bone had been effected.

There is invariably a certain amount of rotation and the alignment is never absolutely perfect.

It is impossible to determine by the unaided eye, touch or measurements, what the actual displacement of the fragments is. The great mass of muscles surrounding the bone, the enveloping skin and fascia and possibly extravasated blood all combine to soften the irregularities of the real outline, just in the same way as a fresh fall of snow smooths out and diminishes inequalities of contour in a landscape.

It is, therefore, impossible to gain any appreciable idea of the extent of bony displacement which exists in these injuries without first having a carefully prepared X-ray picture.

If one will carefully study a specimen, he will have little difficulty in understanding why these patients complain of pain and weakness in the limb, of lameness, of coldness and œdema of the feet, and why the functional activity of the limb must necessarily be greatly impaired. And careful thinkers must feel that a fracture of the femur in the active years of life cannot but be a serious injury, and should demand the careful consideration of all surgeons who are treating these injuries.

It seems to the mind of the writer that the time is ripe for breaking away from the old, accepted traditions and teachings of the great men of the past: to wit, that shortening of an inch or more is the inevitable outcome of such injuries, and that nothing can be done to prevent it.

In the words of Sir Thomas Myles, who has dealt very ably in an exhaustive paper on this subject, "Are we not bound, as surgeons, to avail ourselves of all the advantages that progress in other directions has made possible for us? Is the technic which has made safe the great operations in other branches of surgery not to be utilized in this important part of our work?"

I feel that, in dealing with all cases of fracture of the shaft of the femur in persons in the active years of life, the facts should be stated frankly and plainly to the individual, and he should be made to understand clearly the risks and advantages, on the one hand, and the freedom from risk

and the disadvantages, on the other, and it will be seldom that the active, intelligent patient will not decide to place himself in our hands, with the hope that the realization of the perfect result may be obtained.

Now the question arises: How are we to obtain the ideal result in the treatment of fractures of the shaft of the femur in persons who expect or hope to continue leading an active life?

I feel confident that there is no positive or definite line of treatment open to us, except the exposure of the fragments of the bone by a formal dissection and the restoration of the fragments, actually seeing the parts perfectly dovetailed back in their original position, which is positive assurance against rotary displacement and the first step toward procuring good alignment.

The X-ray is a perfect index of overlapping and shortening, but is of little or no use in determining the question of rotary displacement.

The writer is thoroughly aware, in urging this more radical method of treatment, that he is assuming a great responsibility, which may be diminished by certain limitations.

In the first place, the operation should not be undertaken except by skilled operating surgeons, who are in the habit of doing daily operative work in the hospital. This operation should not be undertaken in private houses, except under very perfect conditions, and should never be attempted on any but reasonably strong and healthy subjects. The operator should have at his command a perfect technic, with suitable instruments and skilled assistants.

Several methods might offer themselves for our consideration: such as wiring the fragments together; the introduction of an intermedullary splint; the use of absorbable pegs of bone or ivory, or some modification of Parkhill's screws and clamps; and lastly, the use of a steel plate and screws as recommended by Mr. Lane.

Time will not admit of discussing all the above mentioned methods, some of which are rarely employed.

The older method of suturing with wire, by drilling the ends of the bones and simply passing the wire around, has been in vogue for many years. It is open to certain objections, particularly in transverse fractures, as it does not retain the fragments in absolutely perfect position and presents more the character of a flail joint, and does not offer the amount of support that is so imperative in dealing with these cases.

However, in long oblique fractures, conditions are different, and the introduction of a wire through a hole drilled in the two fragments and then passing around the bone possibly two or three times to make a sort of ferrule, will suffice often to hold the splintered fragments in position.

Beyond this, the wire is not desirable in dealing with this class of injuries. The use of the wire can be facilitated greatly by using a heavy curved needle, which enables the operator to circle the bone without doing appreciable damage to the soft parts.

The plate and clamp method, as advocated by the late Dr. Parkhill, offers many advantages, insomuch that the wound can be practically closed and the plate left on the outside of the soft parts, and, after union has taken place, these screw supports can be readily removed and the wound will heal up in a very short time. It may, however, be open to the objection that the wound can never be absolutely closed during the process of repair; and it plays very much the same part, in the support of the femur or humerus, that the unfractured fibula does in the support of the tibia when the latter has been broken. It is a most ingenious method and deserves worthy consideration in dealing with this class of injury.

The later method, which has been brought into such prominence by Mr. Arbuthnot Lane, is the one which to-day is receiving the greatest amount of attention.

It consists in the use of long, steel screws, four to six in number, according to circumstances, fastening a strong steel plate which holds the bones rigidly in accurate position one with the other, and which is allowed to remain in the wound after it has been closed, thereby assuring absolute sup-

port to the broken ends during the process of repair. In many cases, the plate may be worn by the patient indefinitely, without causing any discomfort or inconvenience, but if irritation should arise from this, it is open to the objection that it must be removed by a second, though trifling, operation.

The essential feature of all these methods mentioned is the perfect and accurate reduction of the displacement by extension in some form, which is often very difficult, particularly if it is an old injury where attempt at repair has already been made.

To facilitate this, the method devised by Dr. Martin of making extension directly on the upper end of the lower fragment in the wound and drawing it down by extension weights or pulleys, is one of the very best means at our command of correcting the deformity, so far as the actual extension is concerned.

The writer is disposed to regard this method as preferable to the extension of the leg by the use of pulleys, etc., as before recommended in another communication.

Dr. Martin has devised an ingenious pair of clamps which, after the ends of the bones have been accurately adjusted, facilitates the application of the plate and the introduction of the screws. I think this can again be very much modified by the use of curved retractors. This enables the operator to free the bone from any old adhesions, particularly on the opposite side of the wound, and then hold it accurately in position after the readjustment and while the plate is being applied. These retractors, by their simplicity, are preferable to many of the heavy forceps and clamps which have been devised.

The greatest care must be exercised to see that the drill and the screws accurately correspond to each other in size and length, so that the screws will have accurate bearing along their entire course. Care must also be taken to see that the screws are not so long as to perforate the opposite side of the bone, and it is advisable always to have a number of screws of different lengths, corresponding to the size of the bone to be dealt with.

Before dismissing this subject, the site of the incision is worthy of consideration. The wound, which must necessarily be large, is preferably made on the outer side of the quadratus femoris muscle on the anterior surface of the thigh, rather than on the outer side of the leg between the line of the flexor and extensor groups of muscles. The latter incision has the advantage, however, of allowing the more perfect drainage, but the anterior wound can be readily drained by making a counteropening directly down through the muscles, through which a small wick of gauze can be introduced and retained for forty-eight hours, which insures rapid removal of all serum which necessarily collects after so large a wound, thus minimizing the possible risks of infection.

It is important also that, in closure of the wound, all dead spaces should be obliterated as much as possible by the introduction of deep buried catgut sutures.

Mr. Lane lays great stress upon using instruments with as long handles as possible, so as to obviate introducing into the wound even the gloved hand, thus minimizing possible risk of infection.

When the patient is placed in bed, the limb should be thoroughly supported by long lateral supports, either splints or a plaster case, to insure absolute rest of the parts. If this method of treatment is carried out, it will be found that the limb will correspond accurately in measurements to the sound limb, both with regard to length and position. All muscular spasm disappears, as we have no irregular or ragged ends of the bones to cause irritation to the soft parts.

In concluding these remarks, the writer does not wish to advocate the open method of treatment in all cases of fractures of the shaft of the femur, but only in those cases where it is impossible to get reasonably accurate approximation of the bones, as can be readily shown by the use of the X-ray photograph.

This method is not applicable to very young children nor to old or enfeebled persons, but only to those who are in good health and whose habits of life would naturally tend toward a favorable result.

The greatest care must be exercised, not only as to the method of technic employed, but in determining whether or not one's patient will co-operate with every effort of the surgeon to bring about a perfect result.

Too great emphasis, then, cannot be laid upon the importance of dealing with these cases as soon as possible after it has been demonstrated by the X-ray that the ends of the bones are not in accurate position, because the difficulty of the operation is greatly enhanced by allowing these cases to remain for several weeks before operating, in the hope that, by weight and extension, the bones will be brought into better position. The many adhesions and new callus resulting from this delay all add untold difficulties in attempting to bring the ends of the bones into position.

Finally, may I be permitted to offer a word or two of advice to those who may desire to practise some of the suggestions which I have made and who are without any practical experience in this line of work?

1. Find out all that is possible about the seat of fracture by the use of carefully prepared X-ray plates, the pictures to be taken at various angles.

2. Consider carefully what method you think is likely to give the best results.

3. When the fragments are exposed, have a proper pair of calipers to determine the diameter of the bone, and see that the screws in no case penetrate the opposite side.

4. Be certain that you have suitable instruments, proper drills and screws, and also competent assistants, so that you can complete the operation quickly and with as little destruction to the soft parts as possible.

5. Be sure before closing your wound, that it is thoroughly dry and that all dead spaces are obliterated, so that there will be no possible chance for the development of a small hæmatoma, which is so conducive to later infection.

6. Remember in dealing with this class of surgery, that the parts are hard and unyielding, and everything must fit accurately and securely. Nothing can be drawn or pulled

into position, as in dealing with the soft parts. Do not trust too much to nature with the hope that she will correct defects in your joiner work.

7. If possible, try and practise this operation on the cadaver before trying it on the living.

NOTE.—In reviewing a certain number of cases treated after the method above described, the author finds that care must be exercised not to allow the patient to bear his weight upon a limb which is apparently in good shape, as the repair of these injuries requires much longer time than simple fractures, and the callus, though apparently strong, is in many instances soft and yielding; if the patient is allowed to walk too soon, lateral deformity will occur, due simply to the outward bowing of the limb, as the result of superinduced weight of the body.

In this case, it will be noticed frequently that the screws have drawn away from their attachment in the shaft of the bone, and the plate will be forced off at an angle corresponding to the bowing of the limb. Too great care cannot be taken to supplement the use of the plates by suitably applied splints and extension, which should be maintained all through the process of convalescence, thus obviating the tendency to displacement.

FRACTURE OF THE PATELLA.*

WITH A REPORT OF FIFTY-SIX CASES.

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THIS paper comprises a study of 56 cases of fracture of the patella, admitted to the Episcopal Hospital since the year 1905.

To Drs. Neilson, Deaver, Davis, and Frazier, to whose services these patients were admitted, I am indebted for the privilege of reporting these cases. To Dr. H. C. Deaver I am especially indebted for the privilege of operating upon several of these cases, and to his wise counsel, especially in suggestions of operative technic and after-treatment, do I owe much of the success gained.

The primary object of this paper is to discuss the operative technic and after-treatment, therefore little shall be said of the causes, varieties, diagnosis, and symptoms of this very important and interesting fracture.

Of the 56 cases tabulated, 37 were in males, while 19 occurred in females, a ratio of almost two to one. There is no anatomical explanation for the more frequent occurrence of this fracture among males, and, in all probability, it is due to their greater exposure and activity.

The ages in this series range from 18, the youngest, to 77, the oldest. I have arbitrarily classified them according to age as follows:

Four occurred between the ages of 10 and 20; 11 between 21 and 30; 19 between 31 and 40; 14 between 41 and 50; 6 between 51 and 60; 1 between 61 and 70, and 1 between 71 and 80.

* Read before the Philadelphia Academy of Surgery, December 5, 1910.

The greatest frequency occurred between the ages of 31 and 40 years; the period, certainly, of the greatest business activity. It is rather unusual for this fracture to occur under 20 years of age. This is probably due to the bony condition or better muscular control of the young, they being less apt to slip or fall. The youngest patient that I have any personal knowledge of was a boy aged 12 years. This case was operated upon with excellent result, by Dr. H. C. Deaver, at the Children's Hospital of the Mary J. Drexel Home.

Of the 37 males, 19 broke their left patella, while 18 broke the right. Of the females, 11 broke the left, and 8 the right patella.

It appears from this, although the numbers are almost equal, the ratio being larger in the females, that the left patella is more apt to be fractured. Anatomists claim that no asymmetry exists in the lower extremity. Is this fracture purely an accident or is there some cause for its more frequent occurrence in the left patella? Some greater muscular development, a longer step with one leg, or a firmer tread with one foot should be thought of.

The causes given in this series were: "fell," 27; "slipped," 27; "kicked," 2. The histories were somewhat indefinite on this point and I could find only 9 that actually fell from a distance, so whether the "fell" meant a slip and a fall, or a fall from a distance, I cannot say. I am inclined, however, to think the former the case. Several of the patients stated that they slipped, heard something break, and fell.

A great majority of these fractures were of the usual transverse variety, with the large fragment above. A few of this transverse variety showed the reverse to be true, the large fragment being below. Forty-nine cases were of this combined transverse type. Six cases were comminuted; these occurred in two that were kicked, and in four that fell from a distance. The number of fragments in this latter type varied from three to many. No compound fracture occurred in this series.

I have taken a picture of a normal patella in three positions: with leg extended, semiflexed, and acutely flexed. The

patella with the leg semiflexed is seen at the highest point of the condyle of the femur, and it is with the leg in this position that the fracture usually occurs. A sudden strain on the leg, with a violent contracture of the quadriceps extensor muscle, snaps the patella at its weakest and most unsupported point, the lower third.

The symptoms and diagnosis I shall omit, as there is nothing I can add to that already known of the former, and the latter is usually quite easy.

Little shall be said of the non-operative treatment, as all agree that by this method nothing but fibrous union can be hoped for, with more or less separation of the fragments. Certainly in the great majority of instances the results are far inferior to those of the open method of treatment. There are, of course, certain cases that must be treated by this method, as the aged, those in whom some constitutional condition contraindicates operation, or those, who although good operative risks, refuse to be operated upon. Comminuted fractures, with no separation or tilting of the fragments, and, in all probability, no tear in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule, may also be treated by the conservative non-operative method. Of the many conservative methods of treating this fracture, that employed by the late Dr. Agnew is probably as good as any.

I am fully aware that many think the open method of treatment a dangerous one and one that should be done only by a skilled operator. They are willing to operate themselves, but unwilling to teach it. It is dangerous for an occasional operator and one unfamiliar with asepsis and operative technic to do any major operation. I believe that the open method should be taught, but, at the same time, the physician and occasional operator should be alive to the fact that an operation for fracture of the patella is not a minor one, involving, as it does, the largest and at the same time one of the weakest joints in the body, and that if infection does occur, it may end most disastrously. Consequently it is an operation accompanied with a certain definite risk, and one probably attended by much more danger than a simple appendectomy, as the

synovial membrane does not seem to possess the protective power of the peritoneum in taking care of a slight infection.

The best time to operate is now thought to be after all oozing has ceased, after the exudate has reached its height and has even begun to subside, and the tissues have had time to become sealed off. This process usually takes from six to ten days, but it can be hastened somewhat by placing the leg on a posterior splint, with elevation, and the application of an ice bag. In reviewing the histories of these cases, the temperature charts, as a whole, failed to show any marked difference between those operated upon early and those in whom the operation was delayed. The immediate success of these cases depends entirely on whether or not infection occurs. This, I believe, rests between the resistance of the tissues, the virulence of the infection, if one does occur, the preparation of the patient, and the operative technic. Dr. Murphy has pointed out that in an early operation the surgeon is working in tissues somewhat devitalized and, therefore, less resisting and more apt to become infected.

In a letter, which I quote with his permission, Dr. Murphy says: "My reason for postponing the operation for six to ten days is to give the synovial membrane an opportunity to react to the irritation of the trauma and the irritation of the blood-clot in the joint. This reaction produces a cofferdamming of the lymph spaces in the subendothelial layer of the synovial membrane, and lessens the danger of infection very materially."

"We resorted to an injection of 10 c.c. of formalin and glycerine into the joint, immediately after the fracture. This produces a chemical irritation, increases the number of polymorphonuclear leucocytes in the joint, and increases the constitutional polymorphonuclear reaction. It also cofferdams the lymph spaces and insures a prophylaxis against infection. The operation is then done five to seven days after this injection."

Theoretically, with perfect technic, there is nothing to gain by delay other than to allow the oozing, especially from the torn synovial membrane, to cease, as this in an early operation can be quite annoying. Practically, however, we know that

our technic is not always perfect and that infection does sometimes occur. This is lessened by a late operation and, likewise, I believe, the patient suffers much less the first few days after the operation, and the convalescence is shortened, as there is less local reaction.

The incision should be elliptical. It makes little difference if the convexity is above or below. Some surgeons claim the convexity should be above, as it takes the scar away from the knee and is less apt to cause pain with the patient in the kneeling posture. Of the cases I was able to follow, I was unable to substantiate this claim. I think the incision should be an elliptical one, preferably below, as a greater exposure can be obtained well away from the line of fracture, and it lessens the chance of infection and after-complications, especially if silver wire is used. The incision should be carried well down on either side, as I shall point out later, to permit drainage. The next step in the operation, after reflexing well the skin flap, is to divide the prepatellar bursa and fascia lata. The clots are now swabbed out with dry gauze, no fluid being used, and if any irrigation is necessary, only saline solution or sterile water should be employed, as bichloride or other devitalizing or irritating agents are apt to increase the flow of serum and favor infection. The reflected tendon over the broken edges is now retracted, the frayed ends rounded, and by blunt dissection separated a short distance from the margin of the fracture. Often this is impossible on account of the small fragment. The raw surface of the patella should next be freshened, especially in late operations, to get rid of the adherent organizing clot. With a hand drill, beginning in the centre of the upper fragment about one centimetre from the margin of the fracture, a hole is drilled obliquely downward so as to emerge on the broken surface just at the point where the dense cancellous tissue and thin compact lamina unite. A similar opening is drilled in the lower fragment. Through these two holes a silver wire is passed, the fragments are brought together as accurately as possible, and the wires twisted one or two times; the redundant wire is cut off, and the twisted ends that remain are reflected upwards under the

tendon and gently hammered down. Some operators use two wire sutures, one being placed on either side of the patella. The tendon is next sutured with chromic gut, and likewise the torn fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule. At the lower angle of the wound, if the rent in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule does not extend so far down, an opening should be made to permit drainage. The prepatellar bursa and fascia lata are next sutured with chromic gut and the skin by interrupted silkworm gut sutures. The skin wound should not be sewed too tight, neither should too many stitches be applied. The angles of the wound corresponding to the openings in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule should be left open. As a rule, this procures sufficient drainage, but if there has been much oozing, a few strands of silkworm gut or a small piece of rubber tissue can be inserted. The leg is now placed on a well-padded, slightly convex, posterior splint until the patient has fully recovered from the effects of the anæsthetic, when the splint is removed and the leg is placed on a pillow.

The point that I wish to emphasize in the operative technic is the advantage of silver wire. Out of the thirty cases that I have been able to follow, four refractured the patella; three of these were sutured with absorbable material. The one that refractured with wire was due to a fall downstairs, and so great was the strain thrown upon the patella, that the wire cut through the upper fragment. Silver wire is certainly the most aseptic and at the same time the strongest suture material that can be used. The only disadvantage is that it occasionally has to be removed. Removal was necessary in three cases in this series. This undoubtedly can be avoided, provided no infection occurs, but even if skin infection—the most common in this operation—does occur, if the skin incision is well away from the line of fracture, and if the ends of the wire are not left too long and are well covered by the tendon, fascia lata, and prepatellar bursa, removal of the wire may not be necessary. If the wire has to be removed, however, it can be easily done with little inconvenience to the patient. That wire causes

softening of the bone around the opening is highly improbable unless some infection occurs. Wire is certainly no more irritating than any other material used in these cases, as kangaroo tendon, chromic gut, or even, as has been used, silkworm gut.

Cotton, in his excellent book on "Dislocations and Joint Fractures," states that refracture after the eighth week is rare. Only one of this series occurred in that time; the others ranging from four months to four years.

Is bony union obtained in a fracture of the patella? Some surgeons claim not. Personally, I have never examined a sutured fractured patella under the microscope and cannot say. In one of these cases I removed a wire one year after operation. I took the opportunity, clinically, to examine the union and to all appearances it was bony. In this case, even though there had been a slight skin infection followed by a persistent sinus for several months, the bone did not appear soft around the wire, and it took quite a "tug" to dislodge it. As shown by the refractures occurring in this series, the bony union, if one is obtained, is not strong. Why then not reinforce this with a non-absorbable suture?

The after-treatment of these cases is most important. The splint is removed as soon as the patient has recovered from the effects of the anæsthetic, or, preferably, it can be left on through the first restless night following the operation. On its removal, the leg, slightly flexed, is placed on a pillow. Gentle passive motion is begun in a day or so. As it is possible to move the leg through an angle of five or ten degrees without moving the patella, this much motion is taken advantage of. The passive motion is gradually increased so that by the third week the leg can be flexed to a right angle. In the last case that I operated upon, the patient could flex the leg to a right angle on the tenth day, was allowed out of bed on the twelfth, and walked the next day. He was discharged, walking, from the hospital on the sixteenth day. It is a mistake to keep the leg for weeks on a splint or in a cast. Not only does the patient lose much time by the delay, but the muscles become atrophied and the knee more or less ankylosed. These patients will tell you that they were a year getting a

useful limb. Of the ultimate end results, say one year after operation, there is little to choose between. All that I was able to follow got a fairly good functioning result. Some complained of a little stiffness or weakness in the knee on flexion or extension. A few complained of pain in the knee before a storm. On the whole, all showed excellent results; especially was this true of the five private cases operated upon by Dr. Deaver. These patients were treated by the above method, and so excellent were the results, that one would never know, except on close examination, that they had a fracture of the patella. The others, in all probability, would have had as good a result if they could have been properly carried through the late after-treatment.

In this series, two cases died, both from sepsis. One was operated upon on the fourth day, the other on the thirty-fifth day following the accident. The first, a woman, had an abortion ten days before the accident, and when operated upon, unknown to the surgeon, had a bad discharge from her uterus. Whether this patient died from a primary infection or one occurring through her blood, it is hard to say. Her knee did not show much inflammatory change for several days after the operation, although she was profoundly septic. Repeated blood cultures were negative. A culture taken from the knee, however, showed a bacillus morphologically resembling the Klebs-Löffler. Everything possible was done to save this patient's life. Her leg was amputated three and one-half months after the primary operation, but she died two weeks later of exhaustion. The other death occurred in a man who was operated upon five weeks after the accident. I saw the operation performed and the technic was apparently faultless, but evidently some error occurred, for the knee became infected, and the patient died two months later of sepsis.

The majority of cases operated upon showed a febrile reaction ranging from 99° to 102° a day or so after the operation, but the fever usually subsided by the fourth to the sixth day.

In those cases badly infected following the operation, the best chance of saving the patient's life is by early laying open the joint and packing with iodoform gauze.

Some surgeons claim that in comminuted fractures a conservative method of treatment should be used. This rule, as all others, has its exceptions. In one fracture that I operated upon, due to a kick, the patient fell after the blow and evidently tore the fibrous expansion of the quadriceps tendon. In another case, due to a fall from a distance, there was little tear of the fibrous expansion of the quadriceps tendon, but the fragments were tilted and separated by the effusion and clot. These two classes of cases should certainly be operated upon: in the first instance to repair the torn fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule, and in the second, to adjust the fragments and to turn out the clot. In comminuted fractures, especially if broken in many pieces, suturing the bone is often impossible, and the best that can be done is to suture the tendon and carry the patient through a prolonged convalescence.

In the letter referred to above, Dr. Murphy also says: "In cases where the patella is badly fragmented, we believe the use of a flap three-fourths of an inch wide and four and one-half inches long, from the central portion of the quadriceps tendon, passed over the patella and inserted into the ligamentum patellæ by splitting it and looping it half way around, is the most secure means of holding the patella. It does not then involve the traumas in the joint nor the presence of foreign material, such as wire or plates. It is one of the simplest means of treating these fractures, and I believe one of the most secure, following out the plan I do in my cases of resection of the patella for tuberculosis."

In fracture of the patella, if bony union does occur, close approximation of the fragments is essential. This close approximation cannot always be gained by simply suturing the tendon and not the patella, as effusion or movement may dislodge the fragments. In suturing with an absorbable material, a close approximation is possible, but often these sutures soften, elongate, become untied or even break; especially is this so, if close approximation is not obtained and the fragments move independently of each other. In using absorbable material, passive motion must be delayed and the patient is

compelled to pass through a slow convalescence, followed by a more or less stiffness of the joint that usually lasts for several months, to say nothing of the loss of time which many of them can ill afford.

Total number of fractures of the patella.....	56
Males	37
Females	19
Males fracturing right patella	18
Males fracturing left patella.....	19
Females fracturing right patella.....	8
Females fracturing left patella.....	11
Variety: transverse fracture	50
Comminuted fracture	6
Suture: silkworm gut	1
Chromic gut	15
Kangaroo tendon	2
Silver wire	31
After treatment: plaster case	15
Splint	8
Splint and case	9
Pillow	17
Splint (not operated).....	7
Causes: slipped	27
Fell	27
Kicked	2
Tendon alone sutured.....	3
Refractures: absorbable suture.....	3
wire suture	1
Operated upon	49
Not operated upon.....	7

REPORT OF CASES.

E. W., age 42; female. Transverse fracture of patella of left knee; caused by slip. Operation 6 days later; silkworm gut suture; cast. In hospital 57 days. Highest temperature 99.3. Recovered.

S. B., age 20; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; chromic gut suture; cast. In hospital 27 days. Highest temperature 100.3. Recovered.

S. B., age 27; female. Transverse fracture of patella of right knee; caused by slip. Operation 2 days later; wire suture; splint and cast. In hospital 45 days. Highest temperature 99.4. Recovered.

P. N., age 43; male. Comminuted fracture of patella of right knee; caused by fall. Not operated; splint. In hospital 50 days. Recovered.

J. S., age 48; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; splint and cast. In hospital 33 days. Highest temperature 101.2. Recovered.

A. F., age 38; male. Transverse fracture of patella of left knee;

caused by slip. Operation 2 days later; chromic gut suture; cast. In hospital 85 days. Highest temperature 100.1. Recovered.

A. S., age 55; female. Transverse fracture of patella of right knee; caused by slip. Operation 20 days later; wire suture; splint. In hospital 50 days. Highest temperature 100.1. Recovered.

A. N., age 67; female. Comminuted fracture of patella of right knee; caused by slip. Not operated; splint. In hospital 35 days. Recovered.

J. B., age 27; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; kangaroo tendon suture; splint and cast. In hospital 14 days. Highest temperature 100. Recovered.

H. W., age 40; male. Comminuted fracture of patella of right knee; caused by kick. Not operated; splint. In hospital 30 days. Recovered.

H. B., age 38; female. Transverse fracture of patella of left knee; caused by fall. Operation 3 days later; chromic gut suture; cast. In hospital 25 days. Highest temperature 100.1. Recovered.

W. W., age 44; male. Comminuted fracture of patella of left knee; caused by fall. Operation 1 day later; chromic gut suture; cast. In hospital 31 days. Highest temperature 100. Recovered.

G. O., age 37; male. Transverse fracture of patella of left knee; caused by slip. Operation 14 days later; chromic gut suture; splint. In hospital 35 days. Highest temperature 102. Recovered.

A. S., age 54; female. Transverse fracture of patella of left knee; caused by fall. Not operated; splint.

H. B., age 38; female. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 28 days. Highest temperature 100.1. Recovered.

H. R., age 30; male. Transverse fracture of patella of left knee; caused by slip. Not operated; splint.

W. W., age 44; male. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 32 days. Highest temperature 99.1. Recovered.

J. B., age 27; male. Transverse fracture of patella of left knee; caused by fall. Operation 3 days later; kangaroo tendon suture; cast. In hospital 34 days. Highest temperature 100.2. Recovered.

F. S., age 28; female. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 25 days. Highest temperature 100. Recovered.

R. G., age 32; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; splint. In hospital 35 days. Highest temperature 100.1. Recovered.

M. H., age 77; female. Transverse fracture of patella of left knee; caused by fall. Not operated; splint.

E. G., age 50; male. Transverse fracture of patella of right knee; caused by fall. Operation 4 days later; chromic gut suture; cast. In hospital 26 days. Highest temperature 100.2. Recovered.

F. H., age 36; male. Transverse fracture of patella of left knee; caused by slip. Not operated; splint.

L. B., age 60; male. Transverse fracture of patella of right knee; caused by fall. Operation 18 days later; wire suture; pillow. In hospital 45 days. Highest temperature 100.1. Recovered.

W. K., age 44; male. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; splint. In hospital 35 days. Highest temperature 100.2. Recovered.

E. S., age 27; female. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 16 days. Highest temperature 99.4. Recovered.

W. H., age 40; male. Comminuted fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; splint and cast. In hospital 29 days. Highest temperature 100.1. Recovered.

E. S., age 45; female. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; splint and cast. In hospital 46 days. Highest temperature 100. Recovered.

J. S., age 37; male. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; cast. In hospital 25 days. Highest temperature 100.2. Recovered.

C. D., age 31; female. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; cast. In hospital 41 days. Highest temperature 100.1. Recovered.

W. M., age 40; male. Transverse fracture of patella of left knee; caused by slip. Operation 1 day later; wire suture; cast. In hospital 15 days. Highest temperature 99.4. Recovered.

N. R., age 35; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; pillow. In hospital 17 days. Highest temperature 100.1. Recovered.

N. R., age 35; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; pillow. In hospital 12 days. Highest temperature 99.3. Recovered.

E. W., age 34; female. Transverse fracture of patella of right knee; caused by slip. Operation 1 day later; wire suture; cast. In hospital 33 days. Highest temperature 101. Recovered.

J. F., age 42; male. Transverse fracture of patella of right knee; caused by fall. Operation 3 days later; chromic gut suture; splint and cast. In hospital 32 days. Highest temperature 99.4. Recovered.

C. M., age 30; male. Transverse fracture of patella of right knee; caused by slip. Operation 6 days later; chromic gut suture; splint. In hospital 41 days. Highest temperature 101. Recovered.

W. L., age 18; male. Transverse fracture of patella of right knee; caused by slip. Operation 17 days later; wire suture; pillow. In hospital 25 days. Highest temperature 99.3. Recovered.

E. K., age 55; male. Transverse fracture of patella of right knee; caused by slip. Operation 35 days later; wire suture; splint. In hospital 67 days. Highest temperature 105. Died.

J. F., age 53; male. Transverse fracture of patella of left knee; caused by fall. Operation 7 days later; wire suture; pillow. In hospital 27 days. Highest temperature 99.4. Recovered.

J. W., age 55; male. Transverse fracture of patella of right knee;

caused by slip. Operation 12 days later; wire suture; pillow. In hospital 35 days. Highest temperature 100.1. Recovered.

F. T., age 35; female. Transverse fracture of patella of right knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 115 days. Highest temperature 105.3. Died.

J. R., age 19; male. Comminuted fracture of patella of left knee; caused by kick. Operation 4 days later; wire suture; pillow. In hospital 36 days. Highest temperature 100.4. Recovered.

A. T., age 45; male. Transverse fracture of patella of right knee; caused by slip. Operation 5 days later; wire suture; splint and cast. In hospital 28 days. Highest temperature 100.3. Recovered.

A. D., age 40; female. Transverse fracture of patella of right knee; caused by slip. Operation 5 days later; chromic gut suture; splint. In hospital 45 days. Highest temperature 100.2. Recovered.

J. O., age 33; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; chromic gut suture; cast. In hospital 22 days. Highest temperature 99.4. Recovered.

F. M., age 30; female. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 44 days. Highest temperature 100.3. Recovered.

E. W., age 49; male. Transverse fracture of patella of right knee; caused by slip. Operation 8 days later; wire suture; pillow. In hospital 30 days. Highest temperature 100.4. Recovered.

J. S., age 37; male. Transverse fracture of patella of left knee; caused by fall. Operation 6 days later; chromic gut suture; splint. In hospital 29 days. Highest temperature 100.1. Recovered.

T. G., age 22; male. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 30 days. Highest temperature 101.4. Recovered.

F. H., age 20; female. Transverse fracture of patella of right knee; caused by fall. Operation 9 days later; wire suture; cast. In hospital 38 days. Highest temperature 100. Recovered.

L. W., age 28; female. Transverse fracture of patella of left knee; caused by slip. Operation 1 day later; wire suture; pillow. In hospital 34 days. Highest temperature 100.1. Recovered.

G. E., age 41; male. Transverse fracture of patella of left knee; caused by fall. Operation 5 days later; chromic gut suture; cast. In hospital 42 days. Highest temperature 101. Recovered.

M. A., age 39; female. Transverse fracture of patella of left knee; caused by slip. Operation 5 days later; chromic gut suture; cast. In hospital 61 days. Highest temperature 100.4. Recovered.

D. M., age 44; male. Transverse fracture of patella of left knee; caused by slip. Operation 8 days later; wire suture; pillow. In hospital 25 days. Highest temperature 99.4. Recovered.

W. M., age 28; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; splint and cast. Highest temperature 101.3. Recovered.

G. H., age 42; male. Transverse fracture of patella of left knee; caused by slip. Operation 9 days later; wire suture; splint and cast. Highest temperature 98.3. Recovered.

NEPHROURETERECTOMY.

DESCRIPTION OF A SIMPLE AND IMPROVED METHOD.

BY HOWARD LILIENTHAL, M.D.,

OF NEW YORK,

Surgeon to the Mount Sinai and Bellevue Hospitals.

THE attitude of most surgeons regarding the disposition of the divided ureter after nephrectomy seems to indicate a strange unwillingness to complete the operation in a scientific and radical manner. Even when serious infection is present, most operators show a singular trustfulness when the question arises of removing the entire ureteral tube along with the diseased kidney.

In the various society discussions, it is common to note that the usual method of performing nephrectomy includes merely ligation and disinfection of the ureteral stump. One says: "The ureter seldom gives rise to any trouble, even when diseased." Another: "The ureteral stump should be followed down as far as possible (?), then ligated and disinfected." Still a third: "When infected, the ureter should be sutured into the wound," etc. Rarely we see patients presented in whom a total ureterectomy through a gigantic incision has been performed to remove a thickened and inflamed tube, the size of a piece of small intestine.

To quote at random from the literature, Ransohoff, in Keene's "Surgery," vol. iv, p. 259, under "Nephrectomy," says: "Where the isolation of the ureter is possible it may be left to take care of itself after being tied, provided there is no infection. In pus cases, and particularly in tuberculosis, as much of the ureter should be removed as possible; or, if this is not feasible, its proximal end should be fixed in the lower part of the wound by a suture."

On page 260: "When the seat or nature of the ureteral lesion is unknown, the exposure of the duct is best made by

the retroperitoneal operation, which permits an examination of its entire length. A long lumbo-iliac incision is made, beginning below the last rib, as in the operation for exposing the kidney. In a gentle curve it is directed downward and forward an inch within the anterior superior process, and thence continued forward a little above Poupart's ligament, and parallel to it quite to the border of the rectus. The dissection necessary to expose the ureter is but an extension downward of that for the kidney."

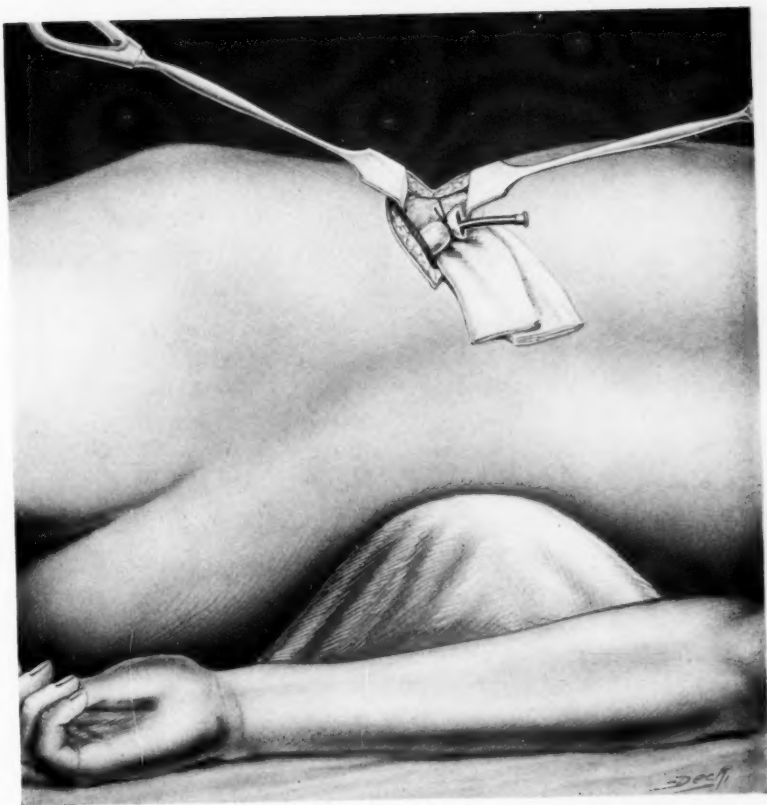
Morris, in "Surgical Diseases of the Kidney and Ureter," 1904, vol. ii, page 242, says: "If the ureter is thickened or diseased, it should be left until after the vessels of the pedicle have been ligated and divided, and then it should be followed down as far as the brim of the true pelvis or lower and there ligated with a medium-sized silk ligature and divided between the ligature and forceps."

Bickham, in "Operative Surgery," page 858, says: "If healthy, the proximal end of the ureter should be cauterized and dropped back into the wound; if unhealthy it should be attached into the wound and drained."

We note throughout a disinclination to prolong the operation in order to remove the ureter, and that in cases in which the duct has been extirpated, it has almost invariably been done at a subsequent operation through an incision beginning at the nephrectomy wound and extending downward and forward to or beyond the edge of the rectus near its pubic insertion.

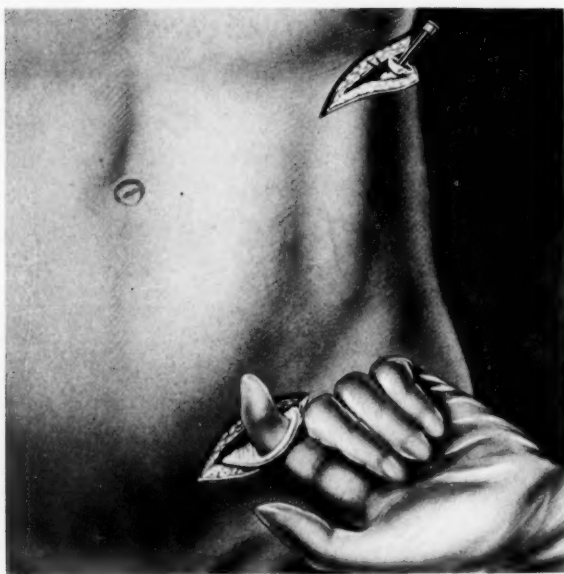
Of the necessity for removal of the diseased ureter, especially in cases of tuberculosis, I am fully convinced. Repeatedly I have seen lumbar sinuses and abscesses, as well as retrovesical suppuration, following the incomplete extirpation of a tuberculous ureter. I have also encountered cases of tuberculous cystitis with the characteristic dysuria and hæmaturia and with tubercle bacilli in the urine, in which nothing but a short stump of diseased ureter had been left following nephrectomy, the other kidney being comparatively healthy. The cystoscopic picture in these cases

FIG. 1.



Showing nephrectomy wound; urethral bougie tied in the ureter.

FIG. 2.



Showing inguinal incision, with ureter and its contained bougie drawn out of the wound.

FIG. 3.



The bougie has been withdrawn and the ureter extracted at the inguinal wound. It still remains attached at the bladder, and the index finger is loosening the lower portion previous to ligation and removal.

is the same as that of tuberculous nephritis—in other words, the same as it was before the operation. I am convinced that if the removal of the diseased ureter could be made easy and rapid, total ureterectomy would be the routine procedure.

In a number of cases I have removed the ureter down to the bladder itself by a method so simple and attractive that I am sure it will at once recommend itself to the profession. It means the prolongation of the total time of operation from five to ten minutes, or, if the patient is in a truly critical condition and adhesions look formidable, the ureterectomy may be postponed.

The steps of the operation are as follows: Extraperitoneal nephrectomy by any of the approved methods. The ureter and vessels being tied separately, the ureter should be cut between two ligatures or forceps and the mucous membrane of the stump cauterized with 95 per cent. phenol. The ureter is now drawn out of the wound if possible, or it is isolated by gauze, and the forceps or ligature having been removed, a good sized flexible *urethral* bougie with conical or olive point is passed down toward the bladder. A ligature is tied tightly around the ureter and instrument, so as to hold the bougie in place and prevent the leakage of infected fluids from the canal. The greater part of the lumbar wound may now be closed with drainage in the usual manner, and the patient is turned on his back. An oblique incision of from $1\frac{1}{2}$ to 3 inches in length, according to the adiposity of the individual or the thickness of his abdominal wall, is made about an inch to the median side of the anterior superior iliac spine. This is carried rapidly through the abdominal muscles to the peritoneum, and then the gloved finger can easily work its way extraperitoneally down to the ureter, which will be invariably and instantly recognized because of the characteristic feel of the instrument within its lumen. A thickened and indurated ureter may be identified even without the bougie. It must be remembered, of course, that the ureter is lifted up with the peritoneum. The finger will now find no difficulty

in separating the ureter and drawing it with its contained bougie out of the wound, when an assistant withdraws the instrument from the nephrectomy wound and tightens the ligature. A gentle pull will draw the upper portion of the ureter out of the inguinal wound, and it may then be easily followed down to the bladder where it must be firmly ligated and cut off, the mucosa being disinfected with phenol. If desired the latter part of the operation may be performed under the guidance of the eye by elevating the foot of the table and exposing the depths with retractors. In ordinary cases the entire procedure takes but little longer than its description. The wound may now be closed by layer suture with a very small 48-hour drain down to the bladder. Should there be infection, which may well occur when the walls of the ureter have been seriously changed by disease, great attention must be paid to the method of drainage. A rubber tube lying for a long time in this region may cause ulceration of the great iliac vessels, with sudden and fatal hemorrhage. Soft tubing, gauze, or rubber dam will here prove serviceable.

NOTE.—Patients illustrating the results of this operation were presented at the November, 1910, meeting of the Section on Surgery of the New York Academy of Medicine, and also at a meeting of the New York Surgical Society held January 11, 1911, at Mount Sinai Hospital.

TECHNIC OF THE OPERATIVE TREATMENT OF APPENDICITIS.*

WITH ESPECIAL REFERENCE TO THE TREATMENT OF PERITONITIS.

BY ALEXANDER B. JOHNSON, M.D.,

OF NEW YORK,

Surgeon to the New York Hospital.

IN the surgical service of the New York Hospital a large number of patients are operated upon for appendicitis every year. At the present time a technic is in use which is practically uniform among the several surgeons, though varying slightly in minor details. The results are good. A mortality in acute cases usually lower than 5 per cent. is obtained, and it has several times happened that a surgeon has operated upon 100 acute cases without a death. The type of appendicitis seen this autumn in New York has been particularly severe, gangrenous cases have been very frequent, with the result of a slightly higher mortality.

Time of Operating.—All acute cases are operated upon at once, at any hour of the night or day as soon as they can be prepared by shaving and an enema. The iodine treatment of the skin is sometimes used; in most cases other methods of cleansing; soap and water, alcohol and ether followed by alcoholic bichloride solution, 1:1000; in a few the skin is slightly rubbed with benzine instead of with alcohol and ether, in others with turpentine.

By acute cases I mean those characterized by a sudden onset of abdominal pain usually followed by vomiting, and by tenderness over the appendical region followed by rigidity more or less marked over the right lower quadrant of the belly. A more or less marked leucocytosis with a relative increase of polymorphonuclear cells is regarded as a sign of great value. A rise of temperature and an accelerated pulse-rate are usually present. Personally, I believe that tender-

* Read before the New York Surgical Society, January 25, 1911.

ness and rigidity in the appendical region, following a sudden attack of general or umbilical pain and vomiting, justify operation, *a fortiori* when with moderate leucocytosis the percentage of polynuclears is high.

In the cases of retrocæcal abscess rigidity is often absent, since the parietal peritoneum of the anterior abdominal wall is not inflamed, in these we depend upon deep tenderness, the detection of a mass, and a characteristic leucocytic count. In deciding for or against immediate operation in cases of doubt, I believe fewer risks are run by operating than by delay.

In the cases of sudden perforation with intense septicæmia we operate as soon as we can, whether late or early.

The Ochsner treatment has not found favor among the surgeons of the New York Hospital.

Incisions.—In nearly all cases, with exceptions to be mentioned, whether acute, chronic, or interval, the McBurney intermuscular incision is used. The cut is made parallel with the fibres of the external oblique, its centre opposite to the spine of the ilium and distant therefrom about two inches. The cut is from two to three inches in length, the muscular layers are separated in the usual manner, and the peritoneum opened in a direction at right angles to the cut in the skin. Before opening the peritoneum all bleeding points are tied. The subsequent procedures vary according to the character of the case.

In cases evidently not complicated by extra-appendicular infection the cæcum is sought for and drawn out of the wound by grasping its wall with a piece of gauze. If the appendix does not at once appear, the anterior white muscular bundle is followed downward, the appendix felt for with the index finger, breaking up such adhesions as exist to bind it down, and delivered.

In pus cases where few or trifling adhesions are present the same method is pursued. Intra-abdominal pads are not used to prevent the spread of infection. Their use is confined to the cases in which omentum or small intestine persists in presenting in the wound, in order to keep these structures out of the way.

In case of a walled-off abscess of several days' duration the abscess is opened and its contents are permitted to escape or are aspirated after the manner to be mentioned later. Diligent search is then made for the appendix with the finger, aided by the eye and good retraction. If the duration of the abscess has been long, and its walls are found dense and firm, and if the appearance of the exudate and of the abscess wall indicates that the appendix exists only as a slough, search for the remains of the appendix is sometimes given up. Such an event is rare, and only occurs when a further search would involve excessive trauma.

The appendix having been delivered together with enough of the cæcum to render the base of the appendix accessible, all instruments, retractors, etc., are removed from the wound. In case adhesions prevent such delivery, the retractors are retained and used to make the appendix more accessible.

The mesenteriolum is now tied off with one or more ligatures passed with an aneurism needle, and if necessary this structure is stripped away from the cæcum a short distance so that it will not interfere with the passage of a purse-string suture around the base of the appendix.

The appendix is then grasped in a piece of gauze in the left hand of the operator or by an assistant, according to convenience, and held vertical, while, with a straight needle threaded with fine silk, or fine catgut, or Pagenstecher thread, a purse-string suture is passed around the base of the appendix through peritoneal and muscular coats of the cæcum a half centimetre or more from the junction of cæcum and appendix. Opposite the beginning and ending of the purse-string a loop of the suture is left long in order to facilitate the inversion of the stump. A small wet pad is then placed on either side of the base of the appendix to protect the cæcum from accidental injury by the cautery.

The appendix is then seized transversely close to its base with a Kocher artery clamp and crushed. A second clamp is applied just distal to the first. The appendix is again crushed, the clamp is removed and reapplied distal to the crushed section. The appendix is then amputated between the two clamps

with the Paquelin cautery, and the cauterization of the proximal portion is continued until nothing projects beyond the remaining clamp but a little carbonized tissue. This is wiped away. The wet pads and the clamp are removed. The operator seizes the two ends of the purse-string suture with his right hand and the opposite loop with his left, while an assistant catches the edges of the appendical stump with a delicate pair of artery forceps, the so-called "mosquito clamp," and while the suture is held tight on either side depresses and thus inverts the appendical stump. The suture is then gradually drawn tight and tied. A second protecting suture is passed outside the first, and tied. At least such is my own practice.

Other methods in use are: 1. Amputation of the appendix with scissors, cauterization of the interior of the stump with cautery or carbolic acid, ligation with fine chromic gut or silk.

2. Amputation with the cautery, ligation of the stump beyond the cauterized area, a method used when the inflammatory infiltration of stump and cæcum prevents inversion.

3. Amputation with scissors or knife after creating a peritoneal sleeve, inversion by a purse-string suture without cauterization. A method now seldom used.

4. Amputation by scissors or cautery. A single suture of fine catgut is passed from side to side through the peritoneal and submucous coats of the appendix and loosely tied; this suture is grasped with forceps and used to invert the stump while the purse-string suture is tied.

5. When the appendix is gangrenous to its base, the gangrenous tissue is cut away and the hole in the cæcum is closed by suture like any other intestinal wound.

My own preference is for the first method described, yet all have yielded about equally good results.

We have had no case of appreciable hemorrhage into the bowel from the appendical stump, nor have we used the more elaborate sutures for inversion of the stump intended to guard against this accident. Proper hæmostasis before the appendix is amputated and the use of the cautery appear to me to be sufficient safeguards.

Treatment of the Peritoneal Exudate.—In the New York

Hospital we have practically given up irrigation of the interior of the abdominal cavity for removal of inflammatory exudates, and we believe that our results have been much improved thereby. We remove the fluid, whether serous, sero-purulent, or purulent, by means of an aspirating nozzle, devised by Drs. Kenyon and Pool, attached to a rubber tube passing to a large bottle which is connected with a modified Sprengel pump operated by steam or a current of water. The pump is of the type commonly known as an "ejector"; it is inexpensive and does not get out of order. The steam is at pressure of 90 pounds as used by us, but 30 pounds pressure is sufficient. In one of our operating rooms the pump is operated by a current of water; it is efficient, but less powerful suction is produced than by steam. The nozzles are made in three sizes, such as are used in the abdomen. The second size is the one most often used. If desired, it may be used as an aspirator and irrigator at the same time. As applied to the fluid peritoneal exudates, we now use it as an aspirator merely.

The nozzle is gently inserted into the abdomen, into pools of exudate, or in directions where it is believed fluid will be found. It is very rapid in operation, and a large amount of fluid can be removed very quickly. The trauma is very slight, far less than by any method of irrigation, new fields of infection are not created, and the infectious material is very completely removed. We believe that our results in bad cases of diffuse purulent peritonitis have been greatly improved by this method of removing pus from the abdomen. Thus, within the past few weeks ten cases of this type have been operated upon in the hospital without a death, seven by my associate, Dr. Hitzrot, and three by myself. The apparatus has, of course, a very wide field of usefulness outside the abdomen, as already pointed out by Kenyon and Pool,¹ but in these cases of wide-spread purulent peritonitis we believe it to be extremely valuable.

In exceptional cases the McBurney incision is not used:

1. In very stout patients with an acute appendicitis, a vertical cut is made through the right rectus muscle.
2. In cases where a retrocæcal abscess is probably present,

a cut is made parallel with the fibres of the external oblique, but above and behind the usual incision, practically the middle one-third of Koenig's incision for exposing the kidney and ureter. Better access and drainage are thus obtained, the last being important, since these cases are often complicated by an extensive retrocolic gangrenous cellulitis.

3. In women, when as it sometimes happens it is impossible to differentiate an acute right-sided salpingitis from appendicitis, or when appendix and tube are both involved in the same inflammatory mass. In these the cut is made in the median line, below the umbilicus.

Drainage.—(a) Interval cases and acute cases with no involvement of other structures than the appendix are closed without drainage.

(b) Abscess cases are drained by a cigarette drain of gauze, surrounded by rubber tissue, or, if a continued discharge of thick pus is expected for some days, by a rubber tube split and filled with gauze. The remainder of the wound is closed by sutures.

(c) When connective-tissue sloughs are expected to form, a tube and a rather thick cigarette drain are inserted, and but few sutures.

(d) When a distinctly purulent exudate has filled the bottom of the pelvis, a long cigarette drain, sometimes a large rubber tube split and filled loosely with gauze, is introduced to the bottom of the pelvis. A second small drain is sometimes passed to the appendical stump.

When the appendix is gangrenous and a small amount of brownish fluid exudate lies free in the vicinity, the wound should not be closed tightly about a drain. Room should be left around a thick cigarette drain for inspection of the deeper portions of the wound, and this, more particularly, in patients who are not young.

In ordinary cases of perforation with a seropurulent or purulent exudate a cigarette drain of moderate size is led to the stump of the appendix. The remainder of the wound

¹ Surgery, Gyn., and Obstetrics, Dec., 1909, pp. 675-678, An Apparatus for Aspiration.

is closed by sutures. In these cases the drain is sometimes omitted and if placed is removed early.

No definite date can be given for the temporary or permanent removal of drains; the indications vary too much in individual cases. In general the simpler the case the sooner the drain is removed permanently.

After-treatment.—All cases of severe general infection are put upon the Murphy irrigation at once. Morphine is omitted if possible. If the patient is doing well, small quantities of liquid food are allowed at the end of 24 hours. The use of ice-water coils on the abdomen in cases of diffuse peritonitis has been abandoned. All the different postures advocated by various surgeons have been tried. At present, ordinary cases are left in the flat dorsal position. Cases of extensive peritonitis are sometimes placed in the Fowler position for 48 hours. On the third day, castor oil or calomel in divided doses is usually given, followed by an enema in 12 hours, if nothing happens. After the bowels have moved freely, a regular diet is gradually resumed.

Interval cases are allowed to sit up on the ninth day, and to walk on the tenth day. There is no rule for the acute infected cases.

Wound infection in clean cases is exceedingly rare. Even in cases long drained, post-operative hernia is very rare when the intermuscular incision has been used.

Results.—Among 111 cases of appendicitis operated upon in the second surgical division of the hospital during the past year (Dec. 1, 1909–Dec. 1, 1910), there were three deaths, a mortality of 2.7 per cent., less than 3 per cent.

Among 118 cases operated upon in the first surgical division there were 5 deaths, a mortality of 4.22 per cent.

Among interval cases there has been, so far as I am aware, no mortality for several years.

The percentage of interval cases operated upon has been small. Most of our cases are received after localized abscess is well developed, or after perforation with a wide-spread purulent peritonitis, or after perforation with a progressive fibrinopurulent peritonitis with numerous purulent loculi in typical situations.

The bad and fatal cases have been of the two types, namely, gangrenous appendicitis with perforation and intense septicæmia, a mixed infection with streptococci and saprophytic organisms and with poor resistance, or perforated retrocaecal appendices with gangrenous cellulitis of the retrocolic connective tissues.

As stated, the treatment of the appendical stump has been of various kinds. We are unable to say that any one method is the best.

The number of fecal fistulæ has been small, nor have they appeared to be more frequent after any particular method of treatment. They have, as a rule, healed without operative interference, after rest in bed, packing of the wound with gauze, stimulation of the granulations, and other simple measures. None, so far as I can recall, have demanded operative interference during the past year.

The cases may be grouped under the following heads:

1. Acute catarrhal (*a*), 81, or 36 per cent.
2. Chronic catarrhal (*a*), 59, or 26 per cent.
3. Abscess (*a*), 32, or 14 per cent.
4. Gangrenous (*a*), 43, or 18 per cent.
5. Suppurative (*a*), 14, or 6 per cent.

Many of the cases recorded as "acute catarrhal" have in reality been cases of suppurative appendicitis, in which the appendix has been filled with pus, ulcerated in its interior, almost perforated, and in which a considerable quantity of seropurulent fluid, often sterile, has been found free in the cavity of the peritoneum.

CONCLUSIONS.

1. Acute appendicitis should be operated upon at once.
2. The appendix can and should be removed in all cases, except when excessive trauma would be created by such removal.
3. The treatment of the stump by any of the methods in common use gives good results.
4. Aspiration of fluid exudates is preferable to irrigation.
5. A large proportion of acute cases demand some form of drainage, brief or prolonged.

DIVERTICULITIS OF THE RECTUM.

A REPORT OF TWO CASES OPERATED UPON, ONE OF THEM WITH
CARCINOMATOUS DEGENERATION.

BY H. Z. GIFFIN, M.D.,
OF ROCHESTER, MINNESOTA.

EXTIRPATION of an inflammatory mass secondary to diverticula in the rectum seems to be unique in surgery. Telling,¹ in his exhaustive review of the literature up to 1908, reports no such case. In a personal review of the literature from January, 1902, to November, 1910, I have been unable to find a recorded instance.

Yet there are reasons for believing that the condition should not be quite so much of a rarity. From pathologic reports, we know that diverticula occur in all parts of the intestine, though undoubtedly most frequently in the sigmoid, splenic flexure, and appendix. In 88¹ cases with diverticula in the large bowel (postmortem), the rectum was involved in nine; and at autopsy the rectum is generally the least thoroughly examined portion of the colon. In 63 cases of vesicocolic fistulæ, Cripps² reports communication with the rectum in 25, the majority of which were inflammatory. Of 15* operations performed in the Mayo Clinic, St. Mary's Hospital, from 1902 to 1910 inclusive, for diverticulitis of the large bowel, two have been done for diverticulitis of the rectum. Moreover, diverticulitis of the rectum simulates carcinoma clinically and macroscopically, and surgical pathologists are probably not on the lookout for the condition.

On the other hand, we can be quite certain that diverticulitis of the rectum is not of frequent incidence. Many pathologic reports state definitely that the occurrence of

* To be reviewed. See also Mayo, Wilson, Giffin, Surg., Gyn. and Obst., July, 1907.

diverticula ceases abruptly with the *appendices epiploicæ* at the beginning of the rectum. Hartwell and Cecil³ review 18 cases of intestinal diverticula, no one of which shows rectal involvement. That the rectum is protected by firmer surrounding tissues, that the musculature is stronger (Schreiber⁴), that internal pressure from accumulated *fæces* is less constant and peristalsis less active, make it probable that diverticula are less common here than in the sigmoid.

Of the nine cases above referred to, in which diverticula were found in the rectum postmortem, seven were purely pathological and two were surgical as well. In these two an enterostomy was done for obstruction. The abstracts are as follows:

(Rotter, 1897.⁵) Male, fifty-three years of age. Stenosis and sigmo-ileac fistula. Symptoms of obstruction for six months. No previous constipation. Operation as for perityphlitis; artificial anus at end of ileum.

Necropsy.—In the upper rectum a stricture 4 cm. long and 3 cm. thick, with narrowing to the size of a lead-pencil was found. Above the stenosis the mucosa was rugose with several fine openings leading to fistulous tracts; these were narrow and communicated with the lumen of the gut and with a small abscess cavity; this was adherent to the vermiform appendix and was in fistulous communication with a loop of the small gut. The condition was regarded as secondary to a former appendiceal abscess.

(Herczel, 1889.⁶) Male, forty-eight years of age. Irregular bowel action. Five months symptoms of enterovesical fistula with passage of air and *fæces* per urethram. Stricture of the bowel 12 cm. from the anus; tumor felt in the left iliac fossa. Carcinoma of the sigmoid flexure diagnosed. At operation the bowel was found to be adherent to the bladder. Subsequent colotomy and death.

Necropsy.—Multiple diverticula containing fecal matter were found in the whole of the rectum; one had given rise to a fistula. Stenosis of the bowel; small abscess cavity outside of it. The fistula was twenty-six centimetres above the anus.

The seven remaining, purely pathologic, cases are as follows:

(Patel and Pellandra, 1906.⁷) Female, seventy years of age. Died from pulmonary accidents. Multiple diverticula in the descending colon, the sigmoid flexure, and the upper rectum.

(Kliven, 1906.⁸) Female, sixty-two years of age. Double row of pouches (over 40) running down the sigmoid flexure on to the upper

part of the rectum, containing faeces and concretions. All opposite the mesentery.

(Fischer, 1899.⁸) Male, sixty-four years of age. Arteriosclerosis with chronic passive congestion. Twenty-five diverticula in the descending colon, the sigmoid flexure, and the rectum; mostly in the two latter places. They were situated near the mesenteric attachments. Adhesions around involved the bowel.

(Fischer, 1909.⁹) Male, forty years of age. Chronic passive congestion in cardiovascular disease. Twenty-five diverticula were found in the rectum.

(Condit, 1902.¹⁰) Female, seventy years of age. Chronic nephritis, bronchitis, emphysema, and congestion. Numerous diverticula in the ascending colon (where there were few only) to the upper rectum in two irregular rows on either side of the mesenteric border. They contained small, hard, fecal masses. Some inflammatory changes in the walls.

(Hale White, 1885.¹¹) Male, fifty years of age. Suppurative peritonitis; no previous history. Numerous diverticula from descending colon to the first part of the rectum. Nearly all of the diverticula contained faeces and entered the *appendices epiploicae*.

(Morison.¹²) Male, fifty years of age. Stout. Three years symptoms of vesico-intestinal fistula.

Necropsy.—The sigmoid flexure was thickened and narrowed at the juncture of the first and second parts of the rectum, the gut being constricted by a narrow membranous band so that the lumen just admitted the tip of the little finger; stenosis of the gut, in all, three inches. Above and below the constriction were several "pits" in the mucous membrane; some were ulcerated at the extremity. A probe was passed from the bowel through one of these into an abscess cavity and thence to the bladder. (The diverticular origin of this case was not recognized by the author.)

Since the publication of Telling's article, from which the above abstracts have been obtained, I have not been able to find additional cases in clinical or pathological literature. The clinical literature has been reviewed to November, 1910, the pathological to October, 1910 (inclusive).

Diverticulitis of the sigmoid has been clearly established within the last ten years as a surgical entity. Diverticulitis of the rectum has apparently been unrecognized surgically. The report of the following cases is therefore of interest.

CASE A38329 (Hospt. 35651).—Mrs. F. C., aged fifty-six years, was examined on June 1, 1910. The family history was negative save that the mother died of carcinoma of the breast at the age of thirty-four. The patient had three children, the

youngest thirteen years old. Menstruation had ceased four years previously. The patient had been unusually healthy and had had no previous illness.

For nine years she thought there had been an excessive amount of mucus in the stools. For three years there had been a sensation of bearing down in the pelvis and an increasing difficulty in moving the bowels, together with a sensation of narrowing of the bowel. A dull ache was present in the rectum at times. No blood had been seen in the bowel movements. There had been very little loss of flesh. No urinary, gastric, pulmonary, circulatory, or other complaints were elicited.

Upon proctoscopic examination, what was considered to be a low-lying rectal cancer was found. Physical examination otherwise was negative.

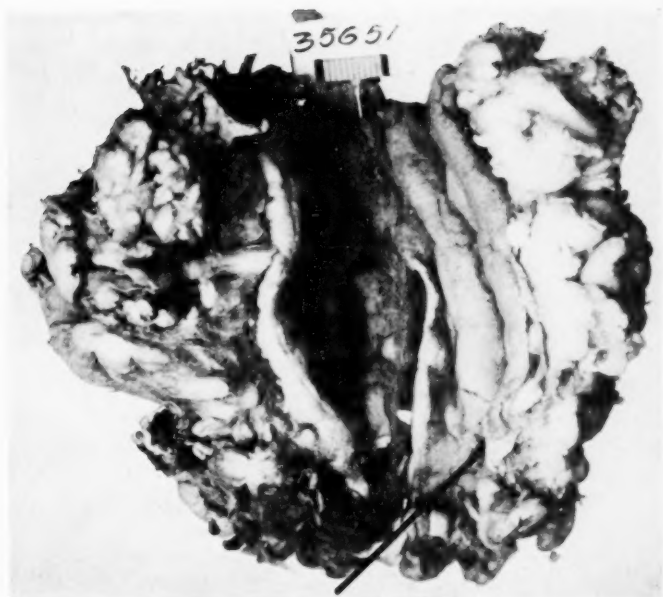
On June 11, 1910, a Quenu-Tuttle perineal operation for low-lying tumor of the rectum was done by W. J. Mayo. The tumor was about four inches in length, producing marked obstruction. Extensive attachment to the vagina and other pelvic structures was found.

The pathologic examination of the specimen revealed two quite perfect diverticula with their surrounding inflammatory mass constituting the "tumor." A report received Jan. 1, 1911, stated that the patient had been gaining slowly in strength. There was, however, very little control of the bowel movement.

CASE A30405 (Hospt. 35351).—Mr. M. D., aged forty-eight years, was referred by Dr. Kenelm Winslow, of Seattle, Washington, and examined May 9, 1910. The family history and personal history were negative. Seven months previously the patient had noticed blood in the bowel movements; the quantity was very small at first, but had gradually increased. There was no old history of colic or obstructive attacks. No constipation. No pain. The bowels had been loose for six weeks, and the patient had lost rapidly in strength and slightly in weight (11 pounds).

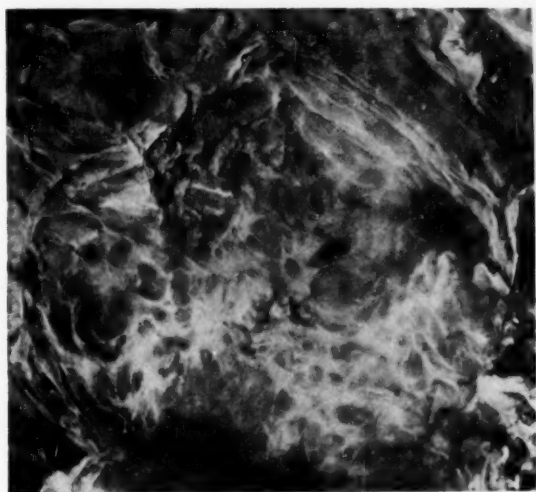
Upon rectal examination, a hard, adherent, nodular mass could be felt. Upon proctoscopic examination, a diagnosis of carcinoma was made. General physical examination revealed evidence of circulatory insufficiency. The urine contained a trace of albumin and a few hyaline casts. Blood-pressure was 190. Heart sounds were of poor quality. Hæmoglobin 76 per cent. Lungs negative.

FIG. 1.



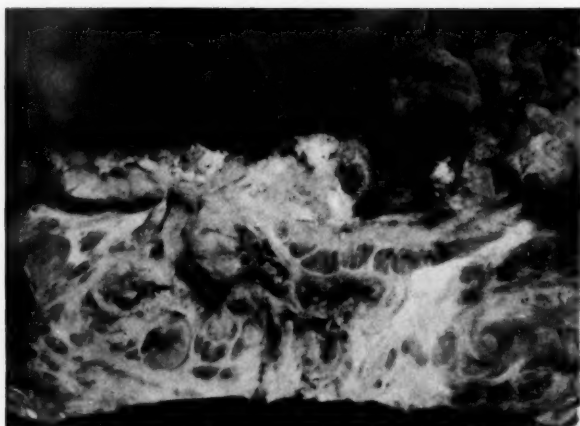
Case I (35651).—X $\frac{3}{4}$ diam. Tumor mass surrounding lower end of rectum, showing diverticulum containing probe and area immediately to left of same, from which the second diverticulum was removed for examination.

FIG. 2.



Case II (35351).—X 1. Section parallel with and close to outer surface of tumor mass in case of carcinoma of the rectum. The transverse sections of the tips of two diverticula are seen close together near the centre of the photograph.

FIG. 3.



Case II (35351).—X 1. Longitudinal section through wall of rectum at right angles to the section shown in Fig. 2, and opening longitudinally, for a considerable portion of their length, the two diverticula shown in Fig. 2. At the right is seen in section the large "cauliflower" carcinoma which had its origin within the diverticula, and which, as it developed, so distorted and filled their lumina that their openings were missed when probing from the mucosal side of the tumor.

Operation.—On May 19, 1910, abdominal resection of the rectum was done by W. J. Mayo. At the operating table the condition was recognized as carcinoma, and the three precedent diverticula were discovered a few minutes later in the laboratory.†

The tumor began four inches above the anus and extended up to the lower sigmoid. The seminal vesicles were involved and had to be removed. The lower two inches of the rectum was saved and union effected by the tube method of suture. The patient made a rather slow recovery. A month later when he was in good general condition, a fecal fistula was closed. Five days after this a left-sided hemiplegia developed suddenly and the patient died.

Carcinoma apparently developing upon diverticula of the large bowel has been reported in two instances.^{13 14} Both of these were in the sigmoid. Our second case illustrates the association of carcinoma with diverticulitis of the rectum.

Inflammatory strictures of the rectum have been difficult of diagnosis, and possibly diverticulitis should be thought of as a rare cause of the condition. Doubtless too many of them have been considered syphilitic.

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† The pathologic examinations in these cases were made by L. B. Wilson. Reference is made to them in his article in the *ANNALS OF SURGERY* for February, 1911.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Clinical Meeting, Held at the Mount Sinai Hospital,
January 11, 1911.*

The President, DR. ELSWORTH ELIOT, JR., in the Chair.

MATAS'S ANEURISMORRHAPHY FOR POPLITEAL ANEURISM.

DR. ARPAD G. GERSTER presented a man, 45 years old, who was admitted to the Mount Sinai Hospital on Sept. 30, 1910, with a seemingly fusiform popliteal aneurism, the size of a hen's egg. On compression of the femoral artery, pulsation stopped in the tumor, but the temperature and coloring of the toes remained unchanged, though previous to compression no pulsation of the dorsalis pedis and posterior tibial could be felt.

Under artificial anæmia, on Oct. 8, 1910, the aneurism was exposed and incised, care being taken not to disturb the connections between the sac and the surrounding tissues. A semi-solid clot being turned out, it became evident that the object under discussion was an aneurism, the upper pole of which was truly fusiform, inasmuch as the entrance of the vessel was exactly polar and had the shape of a flaring cone. The lower half, on the other hand, represented a sacculated dilatation, with the orifice of exit implanted in the anterior wall, the fundus of the sac overlapping the efferent vessel by fully an inch and a half.

The restorative method of intra-aneurismal suture not appearing feasible, the afferent trunk was deligated with catgut just where its calibre began to enlarge, the orifice of exit was closed by two or three stitches, whereupon the entire cavity was obliterated by three superimposed tiers of a running catgut suture. No circulatory trouble ensued, and the wound healed by first intention. The patient was discharged on Nov. 2, and to-day there remains no trace of a tumor.

In connection with this case, Dr. Gerster spoke of the necessity of a reclassification, from the practical standpoint of the surgeon, of the various forms of aneurism. In dealing with the interior aspects of an aneurism, the surgeon must base his technic upon the recognition of the precise architecture, as it were, of the cavity he was to obliterate, a viewpoint naturally neglected by the pure pathologist.

ILEOCÆCAL RESECTION FOR TUBERCULOSIS.

DR. GERSTER showed a man, 40 years old, a tailor, who was admitted to the hospital on Nov. 4 and discharged Dec. 16, 1910. He was suffering from an active tuberculous process involving both apices, and his general condition had become much worse since the formation of a painful tumor in the right iliac fossa, accompanied by symptoms of increasing iliac intestinal stenosis. The diagnosis of ileocæcal tuberculosis was verified by an incision made on Nov. 9, when four inches of the ileum, together with the tuberculous appendix and cæcum and five inches of the ascending colon, were resected. The employment of the cæcoparietal peritoneal incision recommended by Dr. William Mayo much facilitated a clean and bloodless operation of the gut. The end of the colon was inverted and closed; then a Murphy button being fastened into the end of the ileum, an end-to-side anastomosis was rapidly done. The patient's recovery was uninterrupted and uneventful, as far as the peritoneal cavity was concerned. The button was passed in the third week. The fever due to the pulmonary process retained its character during convalescence from the operation. At present, the patient's condition is much improved; he has gained considerably in flesh and strength, and his coping with the pulmonary tuberculosis offers better chances than before resection.

RESECTION OF THE TEN UPPER RIBS FOR THE CURE OF TUBERCULOSIS OF THE RIGHT LUNG.

DR. GERSTER presented a waiter, 30 years old, who had suffered in boyhood from long-continued cough and hæmoptyses. On Nov. 7, 1908, he had a severe chill, with sharp pain and rapid breathing, and three days later he was admitted to the medical service of the Mount Sinai Hospital, whence he was transferred, on Nov. 25, to the surgical division.

After preliminary resection of the tenth rib, the evidences

of pyopneumothorax necessitated incision and drainage, which was done on the same day. The fetid discharge yielded a culture of streptococcus; no tubercle bacilli. The patient's high temperature, which was present before operation, continued unabated, and led to the conclusion that its cause must be sought in the pulmonary process, an assumption verified by the presence of tubercle bacilli in the sputa, and the continuation of the fetidity of the discharge. Evidently, a tuberculous cavity located in the right apex had perforated into the pleural sac.

As the patient was losing ground rapidly, resection of the nine upper ribs, including the first, was done on Dec. 22, 1908. Approach was made by a long incision beginning above the right clavicle, running down the back just outside of the inner margin of the scapula, and merging into the drainage wound at the height of the tenth rib. The considerations which determined this radical procedure were, first, the sound condition of the left lung; second, the fact that the seat of the destructive malady was in the upper portion of the right lung, where the pleural adhesions to the rigid skeletal framework of the chest prevented the collapse of the lung and the approximation of the walls of the lung cavity. Thus it was seen that Dr. Gerster proceeded in this case on lines of argument identical with those followed by Friedrich of Marburg. Accordingly, the scapula being freely detached from the thorax along its inner margin, it was raised and turned outwards, trap-doorwise, exposing the subscapular aspect of the chest. One inch of the first rib was removed, the length of the excised piece of each rib increasing in proportion to the total length of the rib, that removed from the ninth being seven inches. That portion of the wound which corresponded to the first four ribs was tightly packed down with gauze, and the scapula was returned to its normal position, but not sutured.

The formidable procedure was very well borne by the patient, whose fever began to abate within a week after this operation. His pulmonary symptoms, especially the copious sputa and night-sweats, disappeared by May, 1909, and the patient had gained twenty pounds in weight. He was sent to the country for the summer and was re-admitted in October. The lung by this time had everywhere become adherent to the costal pleura, and no thoracic fistula existed, but a strip of lung tissue to the extent of about ten square inches lay exposed to

view along the lower half of the extensive incision. This surface of exposed lung had a bluish-black color; it crepitated on pressure, and on being punctured with a hypodermatic needle, permitted air to escape. It also showed no tendency whatever to develop granulations from its own substance, becoming dry and leathery on exposure to the drying effects of the air. To aid final cicatrization, a long, bridge-like strip of skin, three inches wide and about sixteen inches in length, was detached on Oct. 30 from the inner margin of the original incision, and was shifted into the bottom of the cleft in which the lung lay exposed. A goodly portion of the middle of this bridge necrosed, but enough of it survived to cover the exposed lung. This plastic procedure had induced a more energetic marginal cicatrization, which, being still interrupted by occasional circumscribed cicatricial ulceration, was not yet completely finished. The lung process, however, seemed to be definitely cured.

FRACTURE OF THE FEMUR; OPEN OPERATION, WITH
INTRODUCTION OF INTRAMEDULLARY
SPLINT (ELSBERG).

DR. HOWARD LILIENTHAL showed a boy, ten years old, who was admitted to Bellevue Hospital on October 12, 1910, with a compound fracture of the femur, at the junction of the middle and lower thirds, as the result of a fall from a wagon. At the time of his admission, the boy's temperature was 102°, but it gradually fell and reached normal on October 19. There was an abrasion of the skin on the inner side of the thigh, and a small incised wound on the outer side. Before resorting to operation, traction had been tried to effect restoration of the fragments, but there still remained an inch of overlapping, as shown by the skiagram.

On October 26, 1910, Dr. Lilienthal made an incision, four inches long, antero-externally over the point of fracture, and after exposing the ends of the bone he cut through the newly formed callus and delivered the end of the upper fragment into the wound. He then scraped off some of the periosteum and intervening callus, and with a Gigli saw cut away about two-thirds of an inch of the lower end of this fragment. The sharp point of the lower fragment was removed with bone forceps, and then the marrow was removed for an inch from the ends of both fragments. An intramedullary splint of aluminum was

snugly fitted into the two ends, and after replacing the retracted periosteum, the wound was tightly closed. The interval between the ends of the two fragments after the insertion of the splint was half an inch. A dry dressing was applied, and the extremity was fixed on a posterior splint.

On November 2 a plaster spica was applied, and a skiagram, taken two days later, showed the fragments in perfect position. On Nov. 22 the plaster cast was cut away, and the wound was found healed *per primam*. Moulded splints were then applied. On Nov. 25 a skiagram showed a space between the ends of the fragments which was not firmly bridged with callus. On Dec. 5, although the knee could be passively flexed, he could not move it through more than 60 degrees. He was discharged on Dec. 31, 1910, well, without any support and walking with only a slight limp.

VESICAL CALCULUS AND HYPERTROPHIED PROSTATE.

DR. HOWARD LILIENTHAL presented a man of 60 who for the past twelve years had suffered from dysuria and paroxysmal hæmaturia, and whose symptoms finally became so aggravated that he was confined to bed.

Dr. Lilienthal first saw the patient about two months ago, and upon examination found an enormously hypertrophied prostate, and it was also ascertained that there was practically no residual urine. An operation was advised, but the patient declined it at that time. Finally, he became so wretched that he was brought to the hospital. His urine at this time had the appearance and consistency of pea soup, and an X-ray which was taken showed a large, opaque body, apparently in the upper part of the bladder. Cystoscopy was attempted, but the instrument produced such furious bleeding that nothing could be seen. That same evening, under gas anæsthesia, the bladder was opened above the pubes, and a calculus, weighing three and a half ounces, was removed. A week later, the enlarged prostate was enucleated.

RESULT OF RESECTION OF COLON FOR STENOSING CARCINOMA AFTER SEVENTEEN YEARS.

DR. HOWARD LILIENTHAL presented a man of 60, who had been operated upon seventeen years before for the removal of a stenosing carcinoma of the transverse colon, the anastomosis

having been accomplished by a Murphy button one and three-quarter inches in diameter. A number of apparently infiltrated glands were necessarily allowed to remain, yet the patient had remained perfectly well up to the present time.

This case, Dr. Lilienthal said, had been reported in full in the *New York Medical Journal* for Sept. 1, 1894.

EXPLORATORY LAMINECTOMY.

DR. CHARLES A. ELSBERG presented a man, 42 years old, upon whom he had performed a laminectomy about a month ago. The patient had been suffering from pain in the back, with marked sensory disturbances in the lower limbs, for over two years. When he was brought to the Neurological Institute, in the service of Dr. Joseph Fraenkel, he had typical Brown-Séquard symptoms, with a tender spinous process at the upper level of the sensory disturbances. The diagnosis of spinal tumor was made, and Dr. Elsberg removed the spinous processes and laminae of the sixth, seventh, eighth, and ninth dorsal vertebrae. The pia was found much distended with fluid, and when it was incised, a considerable quantity of fluid escaped, but nothing otherwise abnormal could be found. It was impossible to state whether the fluid was localized—that is, if the condition was one of arachnoid cyst—or not.

The patient made an uncomplicated recovery from the operation, and was remarkably relieved of all of his symptoms. At the end of four weeks he was up and about, almost all of his sensory disturbances had disappeared, all the pathological reflexes had gone, and the power in the lower limbs had returned to a great extent. The patient had lost his sexual power for eight months, and that also had returned.

The patient was presented as almost well, and showed what perfect control he now had over his limbs. Dr. Elsberg said he was unable to state whether the result was due to the decompressive effect of the operation, or whether the symptoms had been the result of pressure from a localized collection of fluid.

SPINA BIFIDA OCCULTA, WITH TROPHIC DISTURBANCES, FOLLOWED BY FIBROLIPOMA OF THE CAUDA EQUINA.

DR. CHARLES A. ELSBERG presented a girl, 24 years old, who was in good health until 1901, when she had several ulcers on the back of the left leg, which were very painful. These

healed, and were followed by similar ulcers on the toes of the left foot. These refused to heal, and in the spring of 1902, one toe was amputated. During the following year she was in the Montefiore Home on account of pain in the left lower extremity and ulcers on the toes. About this time it was noted that she had some sensory disturbances in the left lower extremity.

During 1904 and 1905 several toes were amputated on account of persistent and very painful ulcers. She complained of almost continual pain in the left leg and groin, which was gradually becoming worse. In 1908 the correct diagnosis was first made by Dr. Edwin Beer. The patient had a hairy lipoma in the lumbosacral region, and a spina bifida occulta was suspected. There was anæsthesia over the left half of the labium majus and over the fifth lumbar and first sacral areas, with hypæsthesia and hypalgesia over the second, third, and fourth lumbar areas. The X-ray showed a hiatus between the fifth lumbar and first sacral vertebræ, especially on the left side.

On August 1, 1908, an operation was done, the sac of the spina bifida occulta being removed, and the adhesions between several nerve-roots and dura being separated. The patient left the hospital, improved, on August 22. She was readmitted on May 12, 1910, on account of trophic ulcers on the left foot and severe pain along the outer side of the left leg and foot. Dr. Elsberg did a laminectomy, with removal of the spines and laminæ of the first, second, third, fourth, and fifth lumbar vertebræ. Upon incising the dura, the nerves of the cauda equina were found bound together by a tumor which consisted of fatty and fibrous tissue, a fibrolipoma. It was impossible to free the nerves from the growth, which filled up the greater part of the canal. The left posterior root of the fifth lumbar nerve was thereupon divided, and the dura, muscles, and skin were then closed in the usual manner.

The patient's convalescence from the operation was almost uneventful. The trophic ulcers healed promptly, and the pain in the left leg and foot disappeared. The patient was discharged on July 17 free from all pain in the left leg, and with all the ulcers healed. The pain has not returned since, but a week ago a small ulcer appeared on the back of the leg.

ANEURISM OF THE INNOMINATE ARTERY.

DR. ELSBERG presented a man with a large aneurism of the innominate artery, upon whom he had done several preliminary operations. Four weeks ago he had tied the left common carotid artery under cocaine anæsthesia, and a week later he had tied the second portion of the right subclavian, also under local anæsthesia. The last operation was exceedingly difficult on account of the large number of dilated veins which were encountered. The right radial pulse at once disappeared, and could not yet be felt. The aneurism at first diminished considerably in size, but subsequently again grew larger. The patient complained of very severe pain in his right upper extremity, and was anxious to have anything done which might give him a chance of life. He was willing to take any risk, no matter how dangerous the operation. Dr. Elsberg asked whether, in the opinion of the members of the Society, an intrathoracic operation would be considered justifiable, and whether one might not attempt to do an external aneurismorrhaphy. The dangers and difficulties of such an operation were certainly very great, but in such a hopeless case were not heroic measures justified?

DR. WILLIAM C. LUSK, discussing Dr. Elsberg's case of aneurism, said that at a meeting of the Society last spring, he had presented the specimen of an innominate aneurism reaching to just below the patient's chin, which had been treated with gold wire and galvanism, four of such treatments having been administered. This treatment was attended by marked benefit to the patient, who lived a year and eight months after the first employment of it, and finally died without rupture of the sac. Following three of the wirings when considerable of the introduced wire came in contact with the intima, marked benefit resulted, but after the other wiring when a stiffer filament was used, which was snarled by twisting during its introduction so that it lay more or less centrally within the sac, as demonstrated by an X-ray, no benefit whatever accrued to the patient. The post-mortem specimen showed that those loops of the gold wire which had come in contact with the sac wall lay in a fibrin deposit, while the loops which projected centrally were uncoated and untarnished. In a series of 88 experiments on dogs, the charring of the intima by the electrified wire seemed to be an essential feature in the formation of a permanent clot which

would adhere to the arterial wall. While the wiring of this innominate aneurism, on each of the three occasions it was successful, promptly relieved the patient's distress and made his life very comfortable for the time being, yet it would only temporarily arrest the growth of the aneurism. One striking feature resulting from the treatment of these large aneurisms with gold wire and electrolysis, already recorded by Hare and noted in this case, is the promptness with which the patient is relieved of his suffering. During animal experimentation it was found that a gold wire alloyed with 20 per cent. platinum would not disintegrate under the influence of electrolysis.

RESULT OF OPERATION FOR CARCINOMA OF THE LARYNX AFTER FIVE AND A HALF YEARS.

DR. A. V. MOSCHCOWITZ presented a man, 65 years old, who was admitted to Mount Sinai Hospital on June 12, 1905. He stated at that time that for over thirty years he had suffered from a cough, with mucous expectoration; no blood. About six months prior to admission he began to suffer from slight, gradually increasing aphonia, some dyspnoea, and a tickling sensation in the region of the larynx, particularly on deglutition. The latter symptom had progressed to such a degree that it amounted to a pronounced dysphagia, and the patient became greatly emaciated, having lost over fifty pounds in weight. Examination of the larynx revealed an endolaryngeal carcinoma, apparently springing from the left vocal cord.

An operation for extirpation of the larynx was done by Dr. Moschcowitz on June 16, 1905. The speaker said that as he had always dreaded post-operative pneumonia in these cases, and as he was of the opinion that the greatest danger of such an occurrence was within the first few hours after such an operation, when the discharges invaded the still insensitive trachea and were not coughed up, he decided to do the operation under local anæsthesia, especially as this patient already suffered from emphysema. The operation was done at one sitting, that is, without any preliminary tracheotomy. The trachea was not divided until the larynx was completely mobilized. The stump was fastened by silk sutures into the jugulum, and the pharynx was closed as completely as possible.

There were no post-operative complications so far as the respiratory organs were concerned, but the pharyngeal sutures

gave way, necessitating feeding by means of a stomach tube. When the wound finally cicatrized, the canula was removed, and the patient had worn none since. He gained over sixty pounds in weight, and at the present time, nearly six years after the operation, he could fairly be considered as cured.

The specimen in this case, which was also shown by Dr. Moschcowitz, showed an infiltrating carcinoma at the level of the true vocal cords. The growth was bilateral; the left cord had entirely disappeared, and the right was to a large extent replaced by the growth.

SIMULTANEOUS LIGATION OF BOTH EXTERNAL ILIAC ARTERIES FOR SECONDARY HEMORRHAGE FOLLOWING BILATERAL URETEROLITHOTOMY.

DR. MOSCHCOWITZ said that this case was reported in detail in the *ANNALS OF SURGERY* in December, 1908. The patient was operated upon by him on July 20, 1908, the operation consisting of a bilateral ureterolithotomy for the removal of two calculi from the pelvic portion of each ureter. Both lateral extraperitoneal incisions were closed by layer suture down to a rubber tube drain, which led to the sutured incisions in the ureters. Primary union followed, and the stitches were removed on the sixth day.

Exactly one week after the operation, there being no leakage, Dr. Moschcowitz decided to remove the drain on the left side. The tube came away easily, but was immediately followed by a tremendous hemorrhage, which stopped for an instant, and then recurred in sufficient quantity to fill a two-quart pus basin. A finger was promptly introduced, which instantly controlled the bleeding. The patient was then anesthetized, and the wound reopened. A hole, sufficiently large to admit the tip of the little finger, was found just at the point where the drainage tube had crossed the artery. The artery was ligated above and below the perforation and the wound was packed.

Dr. Moschcowitz said he was just congratulating himself upon a narrow escape, when the sheet covering the patient caught in the safety-pin holding the tube in the right side, and pulled it out about half an inch. This was immediately followed by a terrific hemorrhage, traced to a similar accident to that on the left side, and which required ligation of the right external iliac.

Despite the enormous loss of blood, the patient recuperated

nically, and was discharged, well, on Sept. 4, 1908. Notwithstanding the ligation of both external iliac arteries, there were never any indications of serious interference with the circulation of the lower extremities.

At the present time, about two and a half years after the operation, the patient was in perfect health, with the exception of a slight pyelitis. He was able to attend to his business, which was that of a small shop-keeper, requiring him to be on his feet many hours daily. He felt slightly tired when beginning to walk, but this soon wore off. He had a very small hernia in the centre of each scar, for which he wore a belt; this caused him no inconvenience, and he declined operative repair.

DR. WILLY MEYER stated that, in attempting to explain the fortunate outcome in Dr. Moschcowitz's remarkable case, it seemed plausible to assume that the pressure of the drainage tubes exerted on both external iliacs for six days was sufficiently strong, not only to produce the pressure necrosis of the arterial wall, but to encourage the establishment of sufficient collateral circulation by way of the internal iliacs as well as the epigastrics. That the latter route suffices to a great extent to save the extremity from total gangrene, he had once observed after simultaneous ligation of both internal iliac arteries for hypertrophy of the prostate, done in 1893. On account of a secondary hemorrhage from the external iliac artery on the one side, on the twelfth day after operation; due to pressure necrosis produced by an artery clamp, which had to be left in place on that one internal iliac artery, the common iliac had to be tied. The toes and a part of the metatarsus only became gangrenous, otherwise no special interference with circulation set in.

The main point in this as well as Dr. Moschcowitz's case was, that the vein had not to be tied in conjunction with the artery.

TETANUS FOLLOWING A COMPOUND FRACTURE OF THE SKULL.

DR. MOSCHCOWITZ presented a girl, twelve years old, who was admitted to Mount Sinai Hospital on October 2, 1910, when the following history was obtained: Thirty-six hours prior to her admission she was struck on the head by a flower-pot, filled with earth and a plant, which fell from a considerable height. She was unconscious for five minutes. The resulting scalp wound was sutured at a nearby dispensary, but on the

following day she complained of such severe headache, with pain in the wound, and vomiting, that she was brought to Mount Sinai Hospital. There an infected scalp wound was found, about three inches long, held together by three silk sutures. These were promptly removed, with the escape of about two drachms of bloody purulent fluid. Bare bone and a non-depressed fracture of the skull were then made out.

After this the child felt perfectly well, and was soon up and about in the ward, waiting for the separation of a small sequestrum. On October 23, the twenty-fifth day after the injury, the patient began to complain of general malaise, severe headache, and pains all over the body, particularly in the muscles of mastication. Convulsions developed, during which the tongue was repeatedly bitten, and trismus and risus sardonicus were present: the typical picture of a well-developed tetanus. A culture taken from the wound discharges at this time was negative.

In the course of the next three days, the patient, in addition to the usual sedatives, received 25,000 units of antitoxin injected locally in the region of the injury, subcutaneously, intravenously, and intraspinally. During this time the disease ran a rather severe course, then improvement was noted, which thereafter progressed rather rapidly, with disappearance of all the symptoms.

DR. ARPAD G. GERSTER said, with regard to the long period of incubation in this case, that his own explanation of this, which seemed to be plausible but was of course unproven, was that while the infection occurred at the time of the fracture, the infectious material became lodged in necrosed bone, and did not come in immediate contact with the capillaries. When the necrosed bone was finally cast off, the infectious material then came into direct contact with the capillary circulation, and active symptoms developed.

SUPPURATIVE PORTAL PYLEPHLEBITIS.

DR. MOSCHCOWITZ presented an unmarried woman, 26 years old, who was admitted to the Mount Sinai Hospital, in the service of Dr. Morris Manges, on July 30, 1910. Not only was the patient apathetic on account of the severity of her illness, but she was also of so low a degree of intelligence that it was almost impossible to obtain a correct history or make an accurate physical examination. It appeared that her illness had begun

two weeks before, with high fever, headache, cough, and coryza. One week prior to admission there had been repeated vomiting, with chills and high temperature, followed by profuse sweating.

The physical examination, upon admission, was entirely negative. It was particularly noted that the liver was not enlarged, although the edge of the spleen could be felt one finger's breadth below the free border of the ribs. The white blood count was 12,200, with 80 per cent. of polymorphonuclears. Blood culture was negative. The temperature fluctuated between normal and 106° F.

While the patient was under observation on the medical side of the hospital, examinations of the blood showed what were taken to be malarial plasmodia, but when placed upon quinine she very promptly developed an amaurosis, without any effect upon the chills and temperature.

On August 9 the scleræ were icteric, and for the first time there was noted a distinct enlargement of the liver, to the extent of two fingers' breadth below the free border of the ribs. The leucocyte count gradually rose to 33,600, with 89 per cent. of polynuclears.

The patient was transferred to the surgical side of the hospital on Sept. 3, 1910, with the probable diagnosis of portal pylephlebitis, without any discernible point of entry. Dr. Moschowitz first made an exploratory incision through the upper part of the right rectus, and found the liver congested and enlarged, with the right lobe adherent superiorly to the diaphragm. The condition of the patient did not warrant any extensive exploration. Therefore the incision was rapidly closed, and the ninth rib resected in the anterior axillary line. The pleural surfaces were sutured together, and upon incising these and the underlying diaphragm, a cavity containing about four ounces of thick pus was evacuated. The liver itself was also aspirated, and pus being obtained, though only in small amount, this was also drained by means of tube and gauze.

In spite of the drainage thus established, the patient continued to run a very high temperature; she gradually lost ground for about a month, and became greatly emaciated. The upper cavity discharged pus; the lower one pus mixed with bile. Gradually, however, the cavities assumed a cleaner appearance, the patient's general condition improved, and she was discharged, cured, on Nov. 22, 1910.

Dr. Moschcowitz said the diagnosis in this case was based upon the course and symptoms of the disease, and, above all, upon the operative findings. On account of the patient's recovery there was room for doubt whether or not it was a true case of portal pylephlebitis. The speaker said he could recall three other cases at Mount Sinai Hospital, which were believed to have been true cases of portal pylephlebitis, which terminated in complete recovery, but strict proof was lacking and therefore he did not care to discuss them further. There was one case, however, which he wished to place on record, and he did so by the courtesy and permission of Dr. Gerster, whose private patient the case was. That patient was a girl, seven years old, who had had a number of chills prior to an operation for acute gangrenous appendicitis, with perforation. Her relatives were informed of the gravity of her condition, and were warned of the seriousness of the case if the chills recurred after the operation. Another chill occurred two days after the operation, and thereafter they occurred regularly for two or three weeks, with the temperature varying between normal and 106° F. The liver and spleen became painful and enormously enlarged; icterus developed, and the child became greatly emaciated. An exploratory operation was repeatedly advised by some of the medical men in attendance, but the idea was rejected by Dr. Gerster. During the fourth week, the chills and fever gradually declined in intensity and frequency, with abatement of all the symptoms, and recovery ensued. Following this, the child remained in perfect health for four years, when she was seized with frequent attacks of very profuse hæmatemesis which were attributed to gastric ulcers. No operation excepting a transfusion was done, and the patient died. Post-mortem examination did not reveal a gastric ulcer, but in the liver there were evidences of a diffuse miliary suppuration, which had evidently healed.

Stated Meeting, held at the New York Hospital, January 25, 1911.

The President, DR. ELSWORTH ELIOT, JR., in the Chair.

ANKYLOSIS OF THE JAW (THREE CASES).

DR. FRANK HARTLEY presented the following patients: A schoolgirl, ten years old, who in 1902, six months after an attack of scarlet fever and diphtheria, noticed that her jaw was becoming

stiff, and motion was difficult. Within a few weeks the teeth were about one-quarter of an inch apart, and the jaws could not be moved at all. The patient had to feed herself by placing the food behind her molar teeth.

Examination showed complete ankylosis of the inferior maxilla. The chin was markedly receding, with atrophy of the lower jaw. The teeth were in poor condition. An operative scar was present behind the right ear, at the upper end of which pulsation could be felt through a small, bony defect. This, according to the history, was the result of an extradural abscess operation which was done at the Post-Graduate Hospital in 1908.

On January 5, 1909, Dr. Hartley exposed the right ramus and divided it at the angle with a Gigli saw. The cut ends were then rongeured away for about half an inch at the upper border and one inch at the lower, and an attempt was made to open the jaw. This was impossible, as the opposite side was also ankylosed. The pterygoid and masseter muscles were then united over the extremity of the ramus, and the mucous membrane was closed with plain gut sutures. The skin was sutured with silk, and the wound healed by primary union.

The second operation on this patient was done on March 6, 1909. The temporomaxillary articulation of the left side was exposed by a curved incision, beginning behind the ear, extending over the top and down about three-quarters of an inch anteriorly; then horizontally for three-quarters of an inch (Kraske). The pinna was reflected downward and backward, exposing a hard mass of bone joining the inferior maxilla to the temporal bone. By means of electric bone drills and fine chisels this was divided, and it was then found possible to move the jaw. The bone was then cut away with the rongeurs until the jaws could be separated for a distance of an inch and a half. A fossa was then formed in the temporal bone to receive the ramus. The wound was closed, with drainage, and the patient was discharged on April 17, 1909. She was now able to open the jaw so that the incisor teeth were over an inch and a half apart. The recovery of motion in the jaw has been much assisted by the use of a double plate, with springs inserted, which she wore two hours daily.

January 25, 1911: Lateral motion in lower jaw is good. The inferior maxilla can be depressed two inches from the upper teeth. Muscular power is good.

The second case was a boy, 17 years old, who was admitted to the hospital on April 27, 1910. The history obtained was that five years before, he had fallen, fracturing the right ramus of the lower jaw. It was set by a physician, with apparent recovery. He was able to chew without discomfort, and could open his mouth as well as before the accident. A small, hard lump has appeared at the site of the fracture. This has increased in size since the accident. Not painful.

About two months ago the boy noticed that he could not open his mouth as widely as formerly. Gradually, since then, motion had become more and more restricted until the teeth of the upper and lower jaws could not be separated more than half an inch. He had considerable pain at the back of the jaw when attempting to chew. Otherwise, the patient was in excellent health. An examination showed that attached to the right ascending ramus of the mandible there was a hard tumor, about the size of a large walnut; this was firmly fixed to the ramus and apparently also to the zygoma. The lower jaw was ankylosed.

On May 13, 1910, Dr. Hartley made an incision, about five inches long, beginning at a point behind the midportion of the external ear, following the border of the concha around to a point on a level with the temporomaxillary articulation in front, and then extending horizontally forward for one inch (Kraske). The ear was then retracted downward out of the way and the muscles and other tissues cut through and retracted. The zygoma was divided, and a portion cut away with the chisel and drill. This freed the articulation, and the condyloid process was rongeuired and chiselled away, along with a portion of the temporal bone. The distance between the ramus and the temporal bone was three-quarters of an inch. The jaw could now be widely opened without difficulty.

The wound healed well, and the patient's convalescence was rapid and uneventful excepting for a mild bronchitis, which developed on the eighth day after operation. The patient left the hospital on May 25, twelve days after the operation. He was now able to separate his jaws for an inch and a half; lateral motion was present and there was no pain. January 25, 1911: Jaws separate $1\frac{3}{4}$ inches. Lateral motion and power are good.

The third patient was a married man, 40 years old, a peddler by occupation, and a native of Austria, who was admitted to the New York Hospital on December 29, 1910. His family his-

tory was negative. He had typhoid fever when a youth, and has had psoriasis for the past sixteen years. No history of rheumatism; denied venereal infection.

Six years ago the patient was confined to bed for six months with a fever, accompanied by frequent chills. He had no swelling of the joints at that time, but there was considerable tenderness over his temporomaxillary joints and knees. Since that time the temporomaxillary joints had gradually become ankylosed, and at present he could not open his mouth nor chew. Several of his phalangeal joints were also involved. Dr. Hartley said it was interesting to note the combination of psoriasis and multiple joint affections, to which reference had been made in literature (Menzen, *Archiv. für Derm. u Syphilis*, 1904, lxx. Wollenberg, *Berl. klin. Wochenschrift*, 1909, xlv).

On January 11, 1911, the left temporomaxillary joint was operated on by the Kraske method with extensive removal of bone, the same method being followed as in the previous cases. Twelve days later the opposite side of the jaw was operated on in the same way. The patient was now able to open his jaw fully two inches, and there was also lateral mobility, but the second operation was done so recently that the wound had not yet healed.

Dr. Hartley said that in doing this operation for ankylosis of the jaw he followed the Kraske method, excepting that with the electric burr he was able to remove more bone and to polish the surfaces of the ramus of the lower jaw and temporal bone, and thereby he obtained a more permanent nearthrosis than could be secured by other bone instruments. The use of the burr seemed to be the best means of removing the superfluous bone.

The various operative procedures used in this operation, Dr. Hartley said, showed how imperfect the results were. His personal experience covered eight cases. Where the ankylosis was due to connective-tissue bands following destruction or loss of tissue between the temporomaxillary articulation and the angle of the jaw, Esmarch's operation with Rochet's modification, consisting of the interpolation of muscle, was undoubtedly the best, unless the disease was bilateral.

Mears, in 1883, and König later directed their attention to the temporomaxillary articulation, but by their methods of operation frequent ankylosis resulted. To obviate this, Roser tried the interpolation of gold plate, Helferich excised the root of the zygoma, with the interpolation of the temporal muscle, and

Berosowski excised the condyle alone with the interpolation of the masseter muscle. Kraske, whose operation was the one followed by Dr. Hartley, and with which he was satisfied, made a full excision of the condyloid process, leaving a space of one and a half to two centimetres. No muscle was interpolated.

NERVE IMPLANTATION.

DR. FRANK HARTLEY presented a man, 19 years old, who on September 23, 1908, caught his arm in a cigar machine, receiving an incised wound on the flexor surface of the left forearm about two inches above the wrist-joint. The superficial and deep flexors, which were divided, were repaired on the day of the injury, and the wound healed, without infection, in about a month.

Four months after the receipt of his injury the patient was admitted to the New York Hospital, complaining of sores on the index finger and thumb of the left hand, and numbness of the thumb, index, and middle fingers. Upon examination, these fingers were found to be cold, cyanosed, swollen, and glossy. No pain was elicited from pin pricks, and tactile sense was absent. There was an ulcer on the first phalanx of the thumb. Flexion of the fingers was good, excepting in the index finger. Abduction and adduction of the thumb were imperfect.

At the first operation done by Dr. Hartley (January 11, 1909) an incision was made in the region of the old scar, and the distal end of the median nerve was located. It was bulbous, and was found to be joined to a cord-like structure resembling an obliterated vein. The median nerve was found above and was traced downwards. After excising the bulbous distal end, a defect of two inches remained between the upper and lower segments of the nerve. A section of the saphenous vein was thereupon taken from the thigh, and the two ends of the median nerve, first sutured *à distance* with catgut, were inserted into the lumen of the vein and held in place with fine silk sutures inserted through the vein and nerve sheath. When the patient left the hospital, February 3, 1909, there was no sensation in the affected fingers.

He was re-admitted to the hospital ten months later, having been treated during the interim by electricity and massage under the direction of Dr. Charles L. Dana and Dr. J. Ramsay Hunt, without much resulting benefit. The thumb, index, and middle fingers of the left hand were still cold, glossy, and cyanosed, and the nail of the index finger was trophic. There were no trophic

ulcers. There was marked atrophy of the thenar eminence, an absence of tactile sense in the affected fingers, and they were also analgesic. In the other two fingers sensations were unaffected.

On February 2, 1910, Dr. Hartley exposed the median nerve and examined the site of the previous operation. The nerve, including the section of the transplanted vein, was hard and fibrous, and a piece four inches long was excised. Into the resulting defect a section of the long saphenous nerve, sixteen inches in length, taken from the patient's leg, was cut into four sections and sutured with very fine silk and completely surrounded by Cargile membrane. The wound healed within two weeks and the patient left the hospital at that time.

On January 25, 1911, eleven months after the second operation, an examination showed that the affected fingers were warm, and that tactile sensation had returned. Pain sensation could also be elicited. Both tactile sensibility and pain were less marked in the tips of the index and middle fingers than in the palm and thumb. These sensations, however, were daily becoming more distinct. The thenar eminence was filling out; abduction and adduction of the thumb were good; flexion of the fingers was still somewhat imperfect, but this had to do with the tendon suture and not the nerve.

Dr. Hartley then discussed the different methods of treatment for nerve injury, and stated that a review of the literature and statistics showed that the rapidity of the results obtained by nerve grafting, as compared with suture *à distance* and tubulation was apparent. In his own case the result of nerve grafting was obtained more quickly, more completely, and over a greater loss of tissue, even after a longer interval of time after the injury, than had followed the first operation.

INTERSCAPULOTHORACIC AMPUTATION.

DR. FRANK HARTLEY showed a man, 44 years old, who was admitted to the New York Hospital on October 5, 1910, complaining of swelling in the right shoulder and pain in the upper right arm. His symptoms were of two months' duration. His family history was negative; syphilis was denied, and he did not recall any injury to the shoulder. The pain was worse at night. Early in September he first noticed a lump over the right shoulder-blade, which had increased very rapidly in size, and recently had appeared under the arm-pit. This swelling had

not been tender and he had no pain in the shoulder-joint, although the joint had become stiff since the appearance of the growth in the arm-pit. He also complained of weakness, with drenching night-sweats, and had lost considerable weight.

Examination of the right scapular region showed a mass extending from the vertebral border of the scapula forwards to the midaxillary line. The mass was made more prominent by any movement of the scapula, and the motions of the shoulder-joint were quite limited. The overlying skin was normal in color. In the axilla there were a few prominent subcutaneous veins. The tumor was lobulated, tense, and semicystic in character; it moved with the scapula, and did not seem to be adherent to the chest wall. Aspiration at the most prominent part of the swelling gave a syringeful of bloody serum. The patient's temperature was 103° F. A blood examination showed 4,800,000 red cells, 10,300 white cells, with 74 per cent. of polymorphonuclears and 82 per cent. of hæmoglobin. The general examination of the patient was otherwise negative.

Operation, October 22, 1910: An interscapulothoracic amputation of the right arm was done. The tumor was found to spring from the under surface of the scapula; it was not adherent to the chest wall, and did not involve the bone. The patient made an uninterrupted convalescence and left the hospital twelve days after the operation. He had gained in weight; he no longer suffered from fever and night-sweats, and felt much stronger.

The pathologist reported that the tumor was a spindle-celled sarcoma, showing areas of cystic degeneration. It was encapsulated, did not involve the bone, apparently originating in the soft parts.

The important features to bear in mind in connection with this operation, Dr. Hartley said, were shock and hemorrhage. Death was usually due to shock, with or without hemorrhage. To prevent the occurrence of shock, both Cushing and Crile recommended injecting the nerve trunks with cocaine. In Dr. Hartley's case, no such preliminary injection was made, the only precaution taken being that he waited for complete anæsthetization before division of the nerves. Bloodless dissection of the tissues was the best guarantee against shock. This was his fifth case of interscapulothoracic amputation, with four operative recoveries. There was one death within twenty-four hours after operation. One patient was alive three years after operation, when he was lost sight of.

CYST OF THE PANCREAS (THREE CASES).

DR. FRANCIS W. MURRAY presented the following patients: The first patient was a female, 19 years old, admitted to St. Luke's Hospital in May, 1899. Up to the age of twelve the patient had been perfectly healthy. Then she began to suffer from attacks of what were called gastritis; these attacks, which lasted from ten days to two weeks, were accompanied by vomiting of greenish material, no blood, and during the attacks there were epigastric tenderness and sharp, shooting pains in the stomach, radiating to the back. No history of clay-colored nor fatty stools; no jaundice. Had been very constipated, and during the last month had lost ten pounds. Six weeks prior to admission a tumor was discovered in the epigastric region, and this had steadily increased in size.

Upon admission, the patient looked anæmic, and the skin was of a dirty, yellow color. The heart and lungs were normal; the stomach resonance was a little higher than normal. There was a smooth, hard, tense mass, about the size of a cocoanut, situated in the epigastric region, a little to the left of the median line, and extending into the left hypochondrium. The area of flatness began just below the stomach and extended to the level of the umbilicus: it ran also the left and backwards to the spine, its upper border being about two inches below the angle of the scapula. The right kidney was palpable and freely movable. The patient's temperature was 100; pulse, 90; respirations, 24. The urine was light colored and acid, with a specific gravity of 1010; no sugar nor albumin; it contained a few vesical epithelia.

A diagnosis of pancreatic cyst was made, and a few days later the peritoneal cavity was opened through a four-inch incision, beginning just below the ensiform and running downwards. A pearl-colored cyst was seen presenting behind the gastrocolic omentum, which was adherent. After walling off the peritoneal cavity with gauze packing, 34 ounces of a clear, straw-colored, limpid fluid were withdrawn by aspiration. As the wall of the cyst collapsed, it was drawn up into the abdominal wound, and its cavity exposed through a three-inch incision, when several more ounces of fluid were removed by sponging. The cyst was rather thin walled, lined with a smooth membrane, and extended upwards behind the stomach. No communication between the cavity of the cyst and adjacent organs could be discovered.

The incision in the cyst wall was partially sutured and was also united to the parietal peritoneum. A large rubber drainage

tube was inserted into the cyst, and the abdominal wound was closed down to its lower angle, where the drainage tube was situated. Slight reaction followed the operation, and convalescence was soon established. For about ten days, discharge from the cyst was profuse and necessitated a frequent change of dressings. The convalescence, however, was uneventful; the discharge gradually lessened, and in the latter part of June the patient was discharged, wearing a small drainage tube. The fistula was about five inches in length, and passed downwards into the left hypochondrium. The pathologist reported that the fluid removed from the cyst was alkaline, with a specific gravity of 1.018; it was opalescent and contained free fat, cholesterolin, and leucocytes. It emulsified fat, changed starch into glucose, and digested albumin.

For a year after the operation, a small rubber drainage tube was worn, but owing to the steady contraction of the wound in the abdominal wall it was necessary to substitute a straight silver tube, about three inches in length. This prevented any retention of secretion, was worn without discomfort, and two small daily dressings of gauze were sufficient. When, however, the patient became excited or nervous, the discharge from the sinus was much increased; at such times frequent change of dressings was necessary.

During the following three years the local condition remained about the same; the discharge continued, and repeated attempts to close the fistula by cicatrization were unsuccessful. The general condition of the patient, however, was very satisfactory. She gained in weight and strength, and suffered from no disorders of digestion. In 1902, a chemical examination of the discharge was made by Dr. Gies, Adjunct Professor of Physiologic Chemistry of Columbia University, and he pronounced the fluid as similar to a simple transudate. It contained a minimal proportion of solid matter, a maximal proportion of water, and little or no pancreatic enzyme. In 1906, by means of a probe, a small stone was felt lying near the bottom of the sinus. It was of hard consistency, and seemed to be impacted in the wall of the sinus. It was too large for extraction. This stone has gradually increased in size and at present is about as large as a white walnut. As the patient feels perfectly well and suffers no inconvenience from the daily dressing, she declines an operation for the removal of the stone. Recently, a second chemical examination of the fluid was made in the laboratory of the New

York Hospital, with results similar to those found in 1902. The fluid was slightly turbid, alkaline to litmus, specific gravity 1006. Examination for ferments revealed the fact that amylase was present, trypsin and trypsinogen absent, lipase doubtful, but probably absent, and erepsin, if present, was in very small quantity.

From the number of years the fistula has existed, and from the presence of the stone, it is likely that it will remain permanent. In that respect it is a record case, as the fistula is now twelve years old—in fact, it is the oldest one on record. X-ray picture shows clearly the stone, situated apparently near the tail of the pancreas. Dr. Murray said that the above was first reported in *American Medicine*, June 25, 1902.

The second patient was a female, 48 years old, who was admitted to the New York Hospital on May 30, 1909. Of the family history, the only noteworthy point was that several members on her mother's side died of diabetes. Three months previous to admission the patient began to experience attacks of intermittent pain in the epigastrium. A month later the pain became more or less continuous, and was combined with a throbbing sensation in the epigastric region. Shortly afterwards a small mass was noticed by the patient in the region of the stomach. Since then this mass had gradually increased in size, and pain in the back, radiating down the thighs, was complained of. Appetite was lost, and nourishment, even in small quantities, caused great discomfort. The bowels were constipated, and the patient steadily lost weight and strength. On admission, she was 85 pounds under her ordinary weight.

Aside from the abdominal signs, the physical examination was unimportant. The abdomen was soft, rigidity was absent, and there was no tenderness on pressure. In the epigastric region there was a slight prominence, with apparent pulsation, and on palpation there was found a firm mass, about the size of a coconut. The pulsation was transmitted and not expansile. When the patient was lying down, a bruit and transmitted heart sounds were heard, but in the erect position they disappeared. No heart sounds were heard in the back. Percussion over the mass was tympanitic, and on inflating the stomach with air, the tympanitic area was increased downwards and the stomach appeared to be in front of the tumor. The urine showed a slight increase in urobilin and was negative to the Cammidge test. There was free fat in the stools.

A diagnosis of pancreatic cyst was made, and the abdominal cavity was opened through a 5-inch median incision in the epigastrium. Upon exposing the stomach, the tumor was found to lie behind it, presenting through the gastrohepatic omentum. The tumor felt tense, nodular, and cystic in places, and the pulsation of large vessels in its walls was noticeable. A small incision was made in the gastrohepatic omentum, the cyst exposed, and after proper gauze packing in the peritoneal cavity, the sac was incised between two clamps, a suction tube introduced, and 32 ounces of a reddish-yellow fluid were withdrawn. Exploration of the cyst cavity with the finger located its point of origin in the centre of the pancreas and a little to the right of the median line. A rubber drainage tube protected by gauze was inserted into the cyst cavity, and the abdominal incision was closed down to the point where the tube emerged. The laboratory reported that the fluid removed was reddish-brown in color, faintly alkaline, with a specific gravity of 1012. Microscopically, it contained blood-cells and epithelial cells, showing fatty degeneration, and as it contained albumose, the test for proteid ferment was unsatisfactory. The specimen sent to the laboratory was insufficient in quantity to permit of a satisfactory test for the other ferments.

Convalescence was uneventful, and patient was discharged in the latter part of July, wearing a small drainage tube, which discharged a seropurulent fluid in small amount. After a month's vacation, the patient resumed her duties as an obstetric nurse until November, when, on account of nervousness and weakness, she took a rest until February, 1910. During this month, interference with drainage caused a rise of temperature of a few days' duration, followed by a free discharge of pus through the tube.

In March, 1910, a small gangrenous spot appeared on the right foot, which gradually increased in size and resisted all local treatment. In July, polyuria appeared, large quantities of urine being voided daily, there was great thirst, and the patient suffered from intense pruritus vulvæ. In September she entered the medical wards of the New York Hospital for treatment of the diabetes. Her urine was acid, with a specific gravity of 1045. It contained heavy traces of sugar and albumin, together with urates and calcium oxalate crystals. No acetone and no diacetic acid were present. A slight purulent discharge came from the sinus, and in the stools were found very small globules of fat.

Under suitable diet and medication, improvement began; the

gangrenous spot healed, and the patient was discharged, much improved, on October 18, 1910. Since that time the sinus has completely healed, the patient has gained in weight and strength, and she soon expects to resume her work as a nurse.

The diagnosis in this case, Dr. Murray said, was made from the history of the attacks of epigastric pain, and principally from the fact that the tumor was behind the stomach. It should be noted that the urine was negative to the Cammidge test. The post-operative history was of interest, as diabetes had developed since the operation, and it was probable that chronic pancreatitis existed and perhaps had some etiological bearing on the formation of the cyst. The prognosis was fair, but if improvement did not continue, drainage of the gall-bladder might be of use, as this measure had apparently cured cases of chronic pancreatitis.

The third patient was a boy, nine years old, who was admitted to the Hudson Street Hospital on May 19, 1910, half an hour after he had been run over by a delivery wagon. On admission, there was slight shock, and upon examination the abdomen was found to be distended, rigid, tympanitic, and painful to pressure over its lower part. A small fragment of bone broken off from the crest of the ilium was easily felt. The boy was carefully watched for some hours, and as there was apparent increasing dulness in the flanks, it was deemed wise to explore the abdomen. Through a three and one-half inch incision, a little to the left of the umbilicus, the abdominal cavity was opened and explored. No rupture of the small intestine was found, but at various points, small ecchymotic areas of its wall were noticed. The mesentery was uninjured, and in the right gutter, under the liver, a small amount of free blood was sponged away.

Recovery from the operation was uneventful, and the patient was discharged about three weeks after the accident. After leaving the hospital there was loss of weight and strength, the abdomen became gradually distended, and the patient complained of a feeling of weight in the upper part of the abdominal cavity. His appetite was lost, all foods disagreed with him, and he was rapidly losing strength.

When the patient was re-admitted to the hospital, on June 25, 1910, he was emaciated and anæmic in appearance, but there was no fever nor elevation of pulse. The epigastric region was much distended, and on palpation a tense mass could be felt. It gave the impression of being cystic and extended across from

one costal margin to the other. Light percussion over the tumor was tympanitic; deep percussion revealed slight dulness. Inflation of the stomach revealed gastric tympany above, to the right of its normal situation, and in front of the tumor.

A diagnosis of pancreatic cyst was made, and the abdomen was opened through a median incision starting one inch below the ensiform and terminating at the level of the umbilicus. The stomach was found crowded somewhat to the right by a large, cystic tumor of a pearly appearance, which presented between the stomach and transverse colon. The peritoneal cavity was walled off with gauze packing, the cyst was punctured with a trocar attached to a suction apparatus, and over a quart of clear, limpid fluid was evacuated. On exploration of the cyst cavity with the finger, it was found that it was the cavity of the lesser peritoneum. Behind, the pancreas could be distinctly felt, and, apparently, it was of normal size and consistency. The cavity was drained with a rubber tube, and the abdominal wound was closed down to the point where the tube emerged. The discharge was very profuse for the first three days, necessitating frequent change of dressings. After this, it gradually diminished, patient making an uneventful recovery. When he left the hospital, in the latter part of July, there was some discharge from the sinus, but the latter healed a few weeks later, and the present condition of the patient is most satisfactory. He has gained in weight and strength, his digestion is excellent, and he is perfectly well.

This case, Dr. Murray said, was one of pseudocyst of the pancreas, due to trauma, a condition which had been so well described by Koerte. Evidently the wagon, in passing over the boy's abdomen, caused a slight laceration of the pancreas, with some hemorrhage which escaped through the foramen of Winslow, and was found in the right gutter under the liver. Owing to the escape of blood followed by pancreatic juice into the lesser cavity of the peritoneum, a mild form of peritonitis developed, with closure of the foramen of Winslow. In this way the cavity became gradually distended, and formed the tumor which was found at operation.

TUBERCULOSIS OF THE URETER.

DR. ALEXANDER B. JOHNSON showed a case of tuberculosis of the ureter in which he had removed the ureter five months after nephrectomy for tuberculosis of the kidney. The patient

was a married woman, 26 years old, a native of the United States. She was admitted to the New York Hospital on May 25, 1910, complaining of cramp-like pains in the right loin radiating downward to the bladder and perineum. She had had chills, fever, frequent and painful urination, with occasional attacks of hæmaturia. These symptoms had persisted for four months, and the pain had been severe enough to require the use of morphine.

Abdominal examination and palpation showed an enlarged, very tender, and freely movable kidney. The patient had a slight rise of temperature every evening. A cystoscopic examination, made by Dr. Whiting, showed swelling, congestion and œdema of the mucous membrane of the bladder, most marked near the right ureteral orifice. The urine from the left kidney flowed three times as rapidly as that from the right. The urine from the right kidney contained pus, blood, and albumin; that from the left was negative.

The right kidney was removed on May 29, 1910, by Dr. Eugene H. Pool. It was enlarged to about twice its normal size, and showed numerous cystic cavities containing bloody fluid and varying in size from 5 to 2 cm. in diameter. Throughout the remaining kidney substance were scattered large and small sub-maxillary tubercles. The ureteral opening from the pelvis could not be found. The patient made a rapid recovery and left the hospital apparently well.

On October 7, 1910, she was re-admitted to Dr. Johnson's service with the history that, while her general health had notably improved, she had suffered for several weeks from pain in the right groin and bladder, with fever and chilly sensations. Upon abdominal palpation, tenderness was complained of along the course of the right ureter, and it was possible to feel a cord-like mass, the size of a man's thumb, crossing the brim of the pelvis on the right side. Examination *per vaginam* showed the presence of a similar mass connected with the bladder. This mass was tender, fixed, and elastic.

A second cystoscopic examination made by Dr. Whiting showed that the bladder was normal, with the exception of a congested, swollen area 1 cm. in diameter surrounding the right ureteral orifice. A bougie introduced into the orifice of this ureter met with an obstruction 2 cm. from the outlet; no urine was obtained. Urine obtained from the left ureter was normal.

On October 8, 1910, Dr. Johnson made an incision six inches

long, above and parallel to Poupart's ligament. The muscular structures were divided, the peritoneum pushed toward the median line, and the enlarged ureter exposed. It was firmly adherent to the peritoneum, and about three-quarters of an inch in diameter at its thickest point.

The ureter was removed to a point about 1 cm. from the bladder wall, where its lumen appeared to be obliterated. The section removed was about eight inches long. It contained 35 c.c. of creamy pus, with numerous tubercles.

The patient made a good convalescence, and left the hospital on November 7, 1910. She is now in good health.

CHRONIC JAUNDICE CAUSED BY PRESSURE UPON THE DUODENUM BY A BAND.

DR. JOHNSON showed a man, 22 years old, an Italian, who had been operated upon in another hospital three months before for jaundice. At that time the condition was supposed to be due to gall-stones. No gall-stones were found, however; his gall-bladder was drained for a time, and he left the hospital after four weeks, apparently well.

He was admitted to the New York Hospital on September 8, 1910. Two weeks before that date he began to suffer from pain in the upper right quadrant of the abdomen, with fever, chills, and repeated vomiting. He had become markedly jaundiced.

When Dr. Johnson re-opened the abdomen, on September 10, 1910, firm, dense adhesions were encountered everywhere, obliterating the peritoneal cavity. The gall-bladder was exposed with some difficulty. Palpation of the common duct failed to detect the presence of a stone. The gall-bladder was opened and drained with a tube, and the rest of the wound was closed. Very little bile escaped through the tube, and during the following ten days the patient became more and more deeply jaundiced. His temperature ranged at night between 104° and 105° F.; he suffered much pain in the upper abdomen and was unable to retain food. His stools contained a very small amount of bile. On September 20 Dr. Johnson again opened the abdomen, and after a rather careful dissection, he exposed freely the pyloric end of the stomach and the descending portion of the duodenum. A very dense band of scar tissue could then be seen and felt extending horizontally across the duodenum, just below the pylorus, compressing it firmly. This band was dissected away.

While it seemed probable that the cause of the biliary obstruction had now been removed, it was thought best to open the duodenum and try to demonstrate the patency of the common duct. This was done by a vertical cut in the anterior aspect of the bowel, about an inch and a half in length. The papilla was found and a probe introduced for a short distance, and upon this probe the duct was slit up for a quarter of an inch; flexible bougies were then passed upward toward the liver, the largest size being No. 14 F. This appeared to be tightly grasped by the duct, and no larger instrument was introduced. After this dilatation, bile could be seen flowing freely into the intestine. The bowel was then closed by suture, the rubber drainage tube being allowed to remain in the gall-bladder.

Following this operation, the patient's fever and jaundice subsided, and his stools contained abundant bile. His convalescence was delayed by leakage from the wound in the duodenum, stomach contents and bile being noted in the dressings on the tenth day. This fistula persisted for a month.

The patient left the hospital on October 27, and gradually regained good health. He had, however, occasional fairly severe attacks of abdominal pain, but no jaundice.

TUBERCULOUS BURSITIS OF THE THIGH AND GROIN.

DR. JOHNSON presented a woman, 35 years old, who two years ago first noticed the presence of a small tumor in the left groin. This had slowly increased in size, and had become so large that she had difficulty in walking on account of pain.

Examination showed the presence of a rounded, tender, elastic mass which presented on the anterior and internal aspects of the thigh; its upper limit extended to the fold of the groin; its lower limit about four inches below that level. The tumor lay to the inner side of the vessels. It was difficult to make out the nature of the mass.

Dr. Johnson made a semilunar incision over the most prominent part of the tumor. Upon dissecting up a flap of skin and subcutaneous tissue, it was found that the tumor lay beneath the fascia lata and between and partly beneath the gracilis and adductor longus muscles. It was readily dissected out, and proved to be a sac with thin connective-tissue walls, about the size of a large goose egg. The contents of this sac consisted of a watery, straw-colored fluid. Behind and to the outside of the

sac another and much larger one was found lying behind the adductor longus and pectineus muscles, its superior aspect occupying the thyroid foramen. This sac was also enucleated with the hand. It was about the size of a large, closed fist, and contained thick, creamy tuberculous pus. Its walls were thick and firm. Pathological diagnosis, tuberculous bursitis. Primary union occurred in the wound, and the patient was now quite well.

HEMORRHAGIC PANCREATITIS (RECURRENT).

DR. EUGENE H. POOL presented a man, 43 years old, who was admitted to the House of Relief on October 14, 1910, in the service of Dr. Frank Hartley. He complained of severe, cramp-like pains in the epigastrium, which had begun suddenly about twenty-four hours before admission, three hours after eating, and had soon become intense and almost continuous. He felt nauseated from the onset of the attack, but had vomited only once. He had moderate diarrhoea during and previous to the attack.

He stated that in January, 1908, he had had an almost identical attack. At that time he entered the J. Hood Wright Hospital and was operated upon by Dr. Howard Collins. The operative findings were said to have been typical of acute hemorrhagic pancreatitis, fat necrosis, etc. He made a slow but complete recovery.

The patient had dysentery in 1899 after returning from Cuba. He had been a heavy drinker for years, and in recent years had suffered from morning retching. Otherwise the details of his past history were unimportant.

The main features of his physical examination were evidence of great pain and tenderness in the epigastrium, and very marked muscular rigidity in the upper part of the abdomen. There was no distention nor dulness. Patient appeared to be extremely weak; the extremities were cold; pulse 90 and feeble; temperature subnormal, 97.6°; respirations, 40 to 50. White blood-cells numbered 28,000, with 86 per cent. of polymorphonuclears.

Dr. Pool operated at once under ether anaesthesia. A median epigastric incision was made to the left of the scar of the former incision. Adhesions of omentum to the parietal peritoneum were cut between ligatures, and the stomach and transverse colon were displaced upward with some difficulty. In the space thus exposed there was a large amount of bloody fluid, which was mopped dry. The transverse mesocolon, pancreas, and neighboring struc-

tures presented as a boggy, blood-infiltrated mass, in which no anatomical features could be recognized. A rubber tissue dam was spread out underneath the region of the pancreas, with gauze packing above it, which was brought out at the lower angle of the wound. It seemed unwise to do more than this on account of the patient's extremely poor condition. An infusion was begun towards the close of the operation, which lasted about 25 minutes. Vomiting persisted for 30 hours after the operation, and delirium tremens seemed imminent on the third day. There was a bloody discharge from the wound for seven days, and for ten days after this the discharge consisted of much necrotic tissue, with small blood-clots and a thick, mucoid fluid.

Several times it was reported that the stools contained a small amount of fat. The urine was negative. Attempts to determine the character of the necrotic tissue and the presence of a ferment in the discharge were inconclusive. After the seventeenth day the discharge rapidly diminished, and by the fortieth day the wound had healed. Since then patient had been in good health.

CASES ILLUSTRATING THE USE OF THE RECTUS MUSCLE IN DIRECT INGUINAL HERNIA.

DR. WILLIAM A. DOWNES, in connection with these cases, said the use of the rectus muscle for direct hernia was not new, Bloodgood especially having recommended its use in this class of cases, and Davis, of Philadelphia, had described a procedure very similar to the one shown.

Dr. Downes said the essential features of the operation, as he had performed it in over 50 cases, were as complete removal of the sac as conditions would allow; in many cases the sac was divided into two portions by the deep epigastric vessels, one part above and external, an indirect hernia, and another below and internal, the direct portion. In these cases the vessels should always be divided, thus forming one sac. As a matter of fact, all indirect hernias should be explored by passing the finger through the neck and testing the condition of the posterior wall of the inguinal canal. Frequently, a weakness would be found which was not suspected. A frank sac might not always be present, but it was in just such cases where there was a weakness that recurrence took place, and in which the additional safeguard of rectus transplantation was indicated.

After the sac had been disposed of, the internal oblique and

transversalis were held up by a small, blunt retractor placed at the internal ring, and these muscles were followed down and in until they joined the transversalis fascia at the outer margin of the rectus. The sheath of the rectus, formed by these structures at this point, was opened, and the muscle was exposed down to its pubic attachment. Three sutures of kangaroo tendon were now taken between the outer margin of the muscle and Poupart's ligament, which had been completely freed and exposed by proper retraction. The sutures should be placed from below upward, and about one-half to three-quarters of an inch apart. A fourth suture might be necessary. After all sutures were placed, gentle traction should be made, drawing muscle and ligament well together, and while thus held by an assistant, the sutures should be tied in the order of their insertion.

In his earlier cases, Dr. Downes said, the aponeurosis of the rectus was split on its upper surface, turned down with the muscular fibres, and sutured to Poupart's ligament, but in a number of instances the lower part of the muscle was found to be so thin that this incision went through, and when the sutures were tied, a weak area, triangular in shape, was left in the muscle.

The retractor was now removed from beneath the internal oblique and transversalis muscles, and the usual Bassini operation performed from above downward, the sutures catching Poupart's ligament just superficial to and between those of the first row. The external oblique was then closed in the usual way. It would thus be seen that there were three distinct layers, and not only the weak but the often absent posterior wall of the inguinal canal had been strengthened as it could be done in no other way. The cord was always transplanted. Frequently, the cremaster muscle was so thin and frayed that it had best be cut away; at other times it was thick and strong, and it then should be included in the sutures uniting the rectus with Poupart's ligament.

All of his cases, the speaker said, had healed by primary union, and thus far the results had been uniformly good. Ten had been followed for more than one year. One case, which he showed, was operated upon in November, 1909, for double direct hernia. The patient's occupation was that of a prize fighter, and he stated that he had felt like a new man since the operation. In this case, the epigastric vessels were divided on both sides.

DR. A. V. MOSHCOWITZ asked Dr. Downes wherein the advantage of this method of operating lay in the cure of direct

hernia? If the operator was able to bring over the conjoined tendon and suture it to Poupart's ligament, as he evidently did, wherein lay the advantage of bringing over the rectus muscle first? If the conjoined tendon could be brought over, he did not quite see what the advantage was of putting in a layer of interposed muscle.

Dr. Moschcowitz said that direct hernia was not nearly as common as the indirect, and the cases of the former that he had seen were those where the opening lay towards the median line. Another point of importance in connection with direct hernia was to do the operation *with* transplantation of the cord.

Dr. JOHNSON said that in the very cases where direct hernia occurs, the conjoined tendon was usually a very feeble structure, while the transversalis was scarcely worth mentioning at all. The very reason why this form of hernia occurred was that the internal oblique was inadequate, as had been pointed out years ago by Dr. Blake. The point where the hernia occurred was not so much outward, but close to the median line and to the spine of the pubis, and it was there that we could utilize this strong rectus muscle, whereas the other structures in these cases were hardly worth utilizing at all.

Dr. CHARLES N. DOWD said he had practised the method described by Dr. Downes in five or six cases, and had found it very practical. It certainly gave a re-inforced layer of protection, and presented great advantages in the cure of these direct hernias.

Dr. L. W. HOTCHKISS said he had used and taught essentially this method of operation in direct hernia for several years, and he thought Dr. Downes's point was well taken and a very important one. The combination of the direct with the indirect form of hernia he had found not at all uncommon. He brought over the rectus muscle and transplanted the cord in practically all old direct hernias in elderly men.

Dr. MOSHCOWITZ said that he had not the slightest doubt that the operation, as carried out by Dr. Downes, was a good and proper one; he questioned merely the absolute necessity of the procedure. The speaker said that in order to convince himself that it did not make any essential difference whether we used any muscle at all in these operations, he had, during the past three years limited himself to bringing down the aponeurosis of the external oblique, using no muscle at all, and thus far he had never observed a recurrence in any of the cases where this was done.

DR. PARKER SYMS said he would like to mention what to him, at least, was a new factor in the production of direct hernia. He recently saw a Russian who had a direct hernia which had been purposely produced by a surgeon, the object being to render the subject unfit for military service. The hernia had been produced by the finger invaginating the scrotum, just as one examines an inguinal hernia. The finger had forced a direct opening just below the external ring.

DR. DOWNES, in closing, said he was convinced, with Dr. Johnson, that the internal oblique and transversalis were of little or no service in the closure of this form of hernia. The indication for the use of the rectus muscle was the weakness or absence of the combined lower portion of the internal oblique and transversalis; that is, when the posterior wall of the inguinal canal was wanting. The best illustration of the fact that the usual methods of dealing with this type of hernia were insufficient was the number of recurrences that was seen. Personally, he had operated on probably twenty such cases during the past year.

FRACTURE OF BOTH BONES OF FOREARM; BONE PLATING.

DR. WILLIAM A. DOWNES presented a man, 35 years old, whose arm was caught in a belting six weeks previous to coming under his observation on December 27, 1910. There was marked over-riding of both bones, with moderate side union of the ulna; none of the radius. A four-inch incision was made on the ulnar and radial sides of the posterior surfaces, and Lane bone plates applied. More than an inch had to be removed from each bone before they could be properly adjusted. Very good position was finally obtained, as shown by X-ray. Dr. Downes said the patient was shown at this time, four weeks after the operation, in order to call attention to the value of the plates in this class of cases.

PERFORATED ULCER OF THE JEJUNUM SEVEN YEARS AFTER ROUX GASTRO-ENTEROSTOMY.

DR. JAMES M. HITZROT presented a man, 26 years old, who was admitted to the New York Hospital on August 26, 1910, complaining of acute pain in the abdomen of two days' duration. The pain, which was at first diffuse, subsequently became localized in the right lower quadrant. The patient had vomited once about eight hours before admission. His temperature was 101° ; pulse 140, small and easily compressible. The abdomen

was slightly distended, and no respiratory movements were present. In the midline, above the navel, there was the scar of a previous operation, and about the centre of this there was a slight hernial protrusion which was reducible. The abdomen was rigid and tender, and there was definite muscular spasm, all the symptoms being most marked in the right lower quadrant. There was dulness in both flanks, the mobility of which was not determined owing to the severe pain complained of by the patient. A blood examination showed 18,000 leucocytes, with 80 per cent. of polymorphonuclears.

Inability to speak the patient's language and the definite exaggeration of the signs in the right lower quadrant led Dr. Hitzrot to make the usual appendix incision. Upon opening the peritoneum, an odorless, mucoid fluid gushed out. The appendix was found to be normal. Exploration of the abdominal cavity through the appendix wound showed an abnormality of the intestines in the upper abdomen. A second incision was made through the old scar, exposing the scar of a healed ulcer on the anterior aspect of the stomach, about 1 cm. from the duodenum. The omentum and transverse colon were then drawn out of the abdomen, revealing a Roux gastro-enterostomy, with a perforation in the jejunum on its anterior surface just distal to the line of suture to the stomach, through which intestinal contents oozed. The perforation was closed by a purse-string silk suture, and the line of closure reinforced by a few plain catgut Lembert sutures. The peritoneal exudate was then sucked out and the upper wound closed in layers without drainage. A drain was placed in the pelvis through the appendix cut, which was then closed in the ordinary manner.

The patient made an uneventful recovery, excepting for a right-sided pleurisy, which developed on the fourth day. He was discharged on the twenty-first day, with the wounds healed. It was subsequently learned through an interpreter that the patient was operated on seven years ago in Santiago, Spain, for "dilatation of the stomach."

DR. MORRIS, discussing Dr. Hitzrot's case of perforating ulcer of the jejunum, said that if the ulcer was the result of compression anæmia due to angulation of the gut, it was a comparatively simple matter for explanation; if, on the other hand, we had to deal with an ulcer of the jejunum occurring such a long time after an operation on the stomach by which the gastric contents

had been circuited, that factor might have some bearing upon the etiology of perforating ulcer. It was in line with the idea that he may have direct acid injury of mucosa. It is probable that acid irritation leads to submucous infiltration, and the tissues distended with interstitial infiltrates are temporarily disabled and exposed to digestive and bacterial attack. Such cases are probably less frequent in occurrence than the one due to toxic injury of terminal arteries of the region, but the occurrence of such a jejunal ulcer as Dr. Hitzrot described was significant, and had a meaning which we must not neglect to read.

DR. HITZROT, replying to Dr. Morris, said there was no angulation of the gut in the case he had shown. The perforation lay perfectly free, and the old line of suture was entirely intact. The perforation was on the anterior surface of the jejunum, and there was quite a free space between the line of suture and the perforation. The parts bled freely on incision, and there were no indications of local anæmia.

ABSCESS OF THE FOREARM DUE TO THE GLANDERS BACILLUS.

DR. HITZROT presented a stableman, 28 years old, who came to the Out-Patient Department of the New York Hospital in August, 1910, complaining of an abscess of the left forearm. The swelling had appeared about four weeks before, and had increased slowly in size. It had caused him practically no pain, but recently had become quite soft. No other swellings; no cough; no coryza nor nasal discharge. There were occasional night-sweats.

Examination showed an abscess over the radial aspect of the upper third of the left forearm, over which the skin was slightly reddened. There was no surrounding œdema. The abscess fluctuated and was non-painful. There were no enlarged epitrochlear or axillary glands. There were no abscesses elsewhere, and a general examination of the patient was negative.

Owing to the man's occupation and the curious appearance of the abscess, it was aspirated, and some of the pus, which was thick and yellow in character, was injected into a male guinea pig; some was also planted on culture media, and a smear was also made. The smear showed large numbers of mononuclear cells, with a few broken-down polynuclears; no bacilli. The guinea pig developed a double orchitis, and the culture gave the *Bacillus mallei* in pure culture.

Operation: Under gas, the summit of the abscess was excised, and the abscess was found to be in the deep fascia overlying the muscles, but not extending below it. The cavity was cauterized with pure phenol and tincture of iodine, and packed with gauze saturated with a 1 per cent. solution of iodine in glycerine. The wound healed in the course of two months; the patient had since had no further symptoms, and was now entirely well.

Subsequent cultures and animal inoculation gave the same result as that found at first.

(Bacteriological and animal experiments were made by Drs. Elser and Symmers, to whom Dr. Hitzrot acknowledged his indebtedness for the reports above.)

OSTEOMYELITIS OF THE RADIUS; POST-TYPHOID.

DR. HITZROT presented a young man of nineteen who was admitted to the New York Hospital, in the service of Dr. Frank Hartley, on October 19, 1910, with acute appendicitis, for which he was operated upon and a large appendix filled with pus was removed. His recovery was uneventful. He gave a history of typhoid fever one year ago, and three months before his attack of appendicitis he noticed a swelling over the lower end of the right radius, which had steadily but very slowly increased in size. It had caused him very little pain, and his medical attendant had advised him to let it alone. There was no history of injury to the arm.

Examination showed a swelling of the right radius about an inch and three-quarters above the styloid process. It was very hard, not tender, and seemed to involve the entire thickness of the bone (Fig. 1).

Operation, November 2, 1910: Through a palmar incision the bone was exposed and the periosteum elevated, revealing a thin shell of bone. At one point, reddish, gelatinous material had broken through the bone. The outer shell of the bone was cut away with the rongeur, exposing a mass of reddish, yellow, gelatinous material which was very friable, but which stripped away from the bone quite readily, leaving a clean, egg-shaped cavity. This was bevelled down and sterilized by the application of tincture of iodine, and the wound was closed. It healed uneventfully in the course of ten days.

Pathological report, by Dr. Elser: The organism isolated from the abscess, tested on different media, proved to be a typical

FIG. 1.

A.



B.



Post-typhoidal abscess of radius. A, anterior view; B, lateral view

typhoid bacillus. Agglutination tests with the patient's blood, microscopically and macroscopically, gave a positive typhoid reaction.

TECHNIC OF THE OPERATIVE TREATMENT OF APPENDICITIS, WITH ESPECIAL REFERENCE TO THE TREATMENT OF PERITONITIS.

DR. ALEXANDER B. JOHNSON read a paper with the above title, for which see page 525.

DR. MURRAY, speaking of other conditions to which the method of aspirating the peritoneal fluids described by Dr. Johnson could be adapted, said that it had been used to keep the mouth and pharynx free from mucus during anæsthesia. It could also be employed to empty an ovarian cyst without any leakage of the cyst contents into the peritoneal cavity, and in case of papillary cysts the prevention of infection of the peritoneum by cyst contents is of vital importance. In operations on the gall-bladder and the urinary bladder, the suction apparatus is very satisfactory in keeping the field of operation dry.

DR. HITZROT presented a number of cases of appendicitis with diffuse peritoneal exudate in which the apparatus for cleansing the peritoneal cavity, as demonstrated by Dr. Johnson, had been employed. In all of these cases, free fluid, which was cloudy or frankly purulent, gushed out on opening the peritoneal cavity. With the sucker, as described by Dr. Johnson, the fluid was rapidly aspirated, the chief aim being to cleanse the peritoneal cavity with as little delay and traumatism as possible. In fourteen cases in the service of Dr. Hartley treated by this method in which the peritoneal exudate was examined, four gave the colon bacillus, two the *Staphylococcus aureus*, and eight were sterile. In all of these cases the operation was done as soon as the patients entered the hospital; in five, this was from 36 to 40 hours after the onset of the disease; in six it was from 48 to 60 hours, and in three it was three days.

DR. JOHNSON said that Dr. Frank Hartley had done more to develop this apparatus and perfect its use than any one else. It was originally devised by Drs. J. H. Kenyon and Eugene Pool.

DR. HARTLEY said that some years ago an article appeared in one of the French journals describing a method of employing suction for the purpose of keeping the throat clean during anæsthesia. The speaker said the method attracted the attention of Dr. James H. Kenyon and himself, and a month or two later with the help of a small pump they fitted up this apparatus, which

could be used for various purposes other than the removal of peritoneal exudates, to which Dr. Johnson had limited his remarks. It could be used for the removal of the contents of echinococcus cysts of the liver, and for draining the gall or urinary bladder. By this method the drainage was so perfect that the skin was kept dry, avoiding irritation and secondary eczema. Its adaptability for the purpose of removing mucus from the upper air-passages during anæsthesia had already been referred to, and it was also useful following operations about the throat, where it lessened the danger of aspiration pneumonia.

DR. GEORGE E. BREWER said he wished to testify to the value of this apparatus. About a year ago, Dr. Kenyon had introduced a similar one at Roosevelt Hospital, connecting it with an ordinary water main to secure the necessary suction force. The results obtained with it had been very satisfactory, although thus far they had not employed it in cases of general peritonitis, but he intended to do so. They had employed it in ordinary gall-bladder drainage and in the removal of cystic exudates, and it had also been found very useful for the removal of blood in operations on the Gasserian ganglion.

GAS CYSTS OF THE INTESTINE.

DR. P. R. TURNURE showed a specimen of this condition. The specimen consisted of about two feet of small gut taken near the junction of the jejunum and ileum. The patient was a Chinaman, 57 years old, a laundryman by trade, who was admitted to Dr. Johnson's service at the House of Relief on January 18, 1911. He gave a history of indefinite abdominal pain of several months' duration, but at no time was he obliged to give up his occupation. About eight o'clock on the day of admission he was suddenly seized with cramp-like pains in the epigastric region; he vomited and the abdomen rapidly began to swell. He was brought to the hospital in the ambulance at 3 P.M., and upon admission he showed all the symptoms of a perforation of either the stomach or duodenum, and an immediate operation was decided on.

The usual incision was made, and upon opening the peritoneum a large quantity of gas escaped, and the entire cavity was found to be distended with a serosanguineous fluid, which was almost clear. Over a gallon and a half of this fluid was removed by aspiration. The specimen shown by Dr. Turnure presented itself in the wound. At the time of operation, the hundreds of cysts

which are plainly apparent at the present time were at least three or four times their present size, and although many can still be seen to be pediculated, a far greater number were so attached at that time. When punctured, these cysts promptly collapsed, with the escape of air. The rest of the peritoneum was irregularly injected, opaque, and covered by a thin, slightly reddish, fibrinous exudate. As the condition of the patient was very low, no more extended investigation was possible, and the wound was closed. Death occurred at eleven o'clock that night.

At the autopsy, a perforated gastric ulcer was found in the lesser curvature near the pyloric opening. The stomach was very adherent to the gall-bladder, and the perforation was just to the inner side of this mass.

Bouillon cultures from the abdominal fluid showed several varieties of bacilli. Agar plates showed three varieties of colonies, namely, *Proteus*, *Bacillus lactis aërogenes* and *B. coli communis*. Anaërobic cultures taken from the cysts in the peritoneal cavity showed innumerable large Gram positive bacilli, which failed to grow under aërobic conditions. The organism found, therefore, belonged to the anaërobic group. It was, however, somewhat smaller than the *Bacillus lactis aërogenes* of Welch.

Pathological examination (preliminary report): Just outside of the longitudinal muscular coat (in the section) there was a conglomeration of cystic spaces, varying in size from $\frac{1}{4}$ mm. or smaller to about 4 mm. in their long diameter. These spaces were irregularly ovoid, separated in places by merely a thin connective-tissue wall, in other places by larger areas of tissue. The walls were composed in the main of longitudinally placed connective fibrils, the lining of the cysts showing a single layer of flattened endothelial-like cells. Although for the most part lying outside of and partly in the longitudinal muscular coat, the cysts had penetrated the circular layer in places, encroaching upon the mucosa. The solid connective-tissue areas between some of the compartments showed an active proliferation of fixed connective-tissue elements, and a moderate infiltration with lymphoid cells. It seemed that the spaces above described might have some relationship to the lymphatics, inasmuch as some of them could be traced into enlarged channels not unlike lymph spaces.

These preliminary examinations, Dr. Turnure said, would seem to justify the belief that the condition was that known as "gas cysts of the intestine."

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held December 5, 1910.

The President, DR. R. G. LeCONTE, in the Chair.

VOLKMANN'S ISCHÆMIC PARALYSIS.

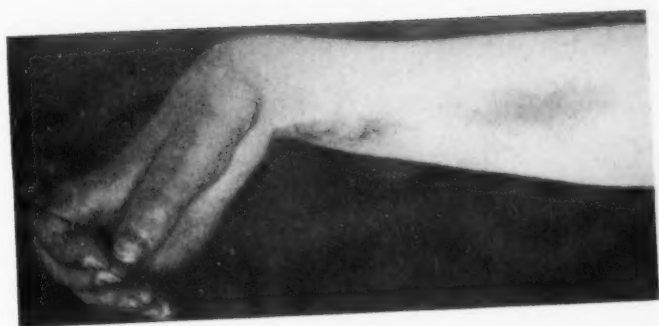
DR. JOHN H. JOPSON presented a boy of eight years, who was brought to him about three weeks after sustaining a fracture of both bones of the forearm, which had been treated by the use of anteroposterior splints. When the splints were removed, about ten days after the accident, pressure sloughs were found on both the flexor and extensor surfaces of the forearm. Contracture of the fingers and hand quickly followed. The contracture was typical of Volkmann's ischæmic paralysis, viz., a fixation of the part due to shortening of the flexor tendons of the fingers. There were unhealed ulcers on the flexor and extensor surfaces. Two months later the boy was admitted to the Presbyterian Hospital.

On examination of the arm, the ulcerations were found to be healed. That on the flexor surface was adherent to the subcutaneous tissues. The hand was held in a position of flexion and pronation, the fingers extended and abducted (Fig. 1). The hand could be moved about 30°. When the fullest extension possible was obtained, the fingers were flexed; when the hand was flexed, they were extended. There was anæsthesia over the distribution of the ulnar nerve in the hand.

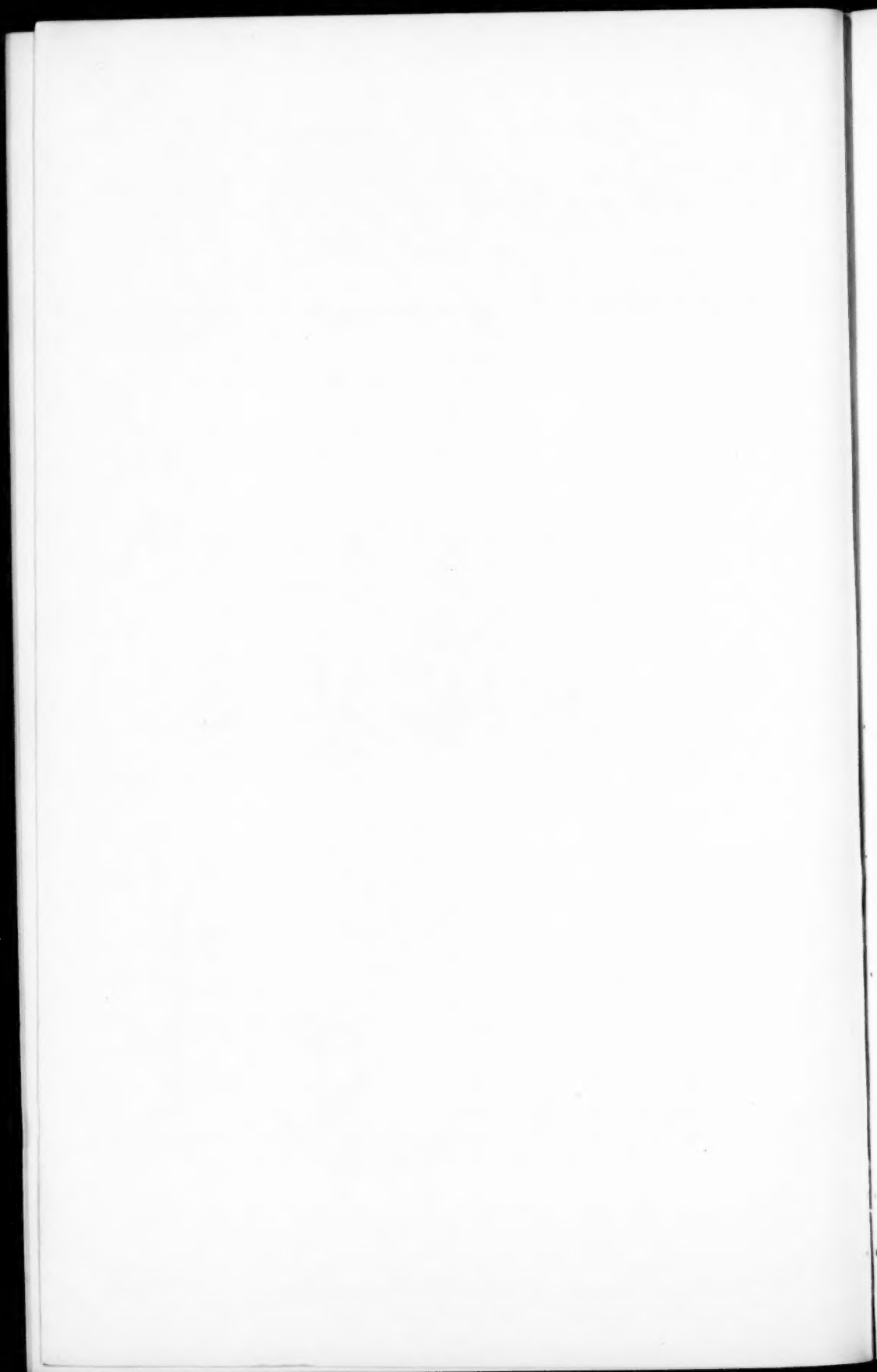
Massage and passive motion were used for the next two months without much improvement.

Operation five months after original injury. An incision was made at the site of the scar on the flexor surface of the forearm, four inches long. The tissues beneath were adherent and were separated. The muscles were yellow in color and in a state of degeneration, brittle, and fibroid. Both the median

FIG. 1.



Volkmann's ischaemic paralysis.



and ulnar nerves were imbedded in fibrous tissue, and adherent, thinned out, and atrophied as if by pressure, for a considerable distance in the lower third of the forearm, but above this point abruptly becoming of normal appearance.

Muscles and nerves were dissected apart, and myotomy and lengthening of the flexor sublimis digitorum and palmaris longus were practised. The flexor profundus was not lengthened, although contracted, this being deferred for a second operation, if necessary. The forearm and hand were dressed upon a palmar splint.

This operation has been followed by some improvement. There is an increased range of motion; the area of anæsthesia is lessening, and further improvement is hoped for, especially as the condition in which the nerves were found was one which would promise a gradual improvement.

Dr. Jopson added that both the etiology and treatment of this condition have been the subject of considerable discussion, and the valuable paper of John Jenks Thomas, in the *ANNALS OF SURGERY* for March, 1909, contains an excellent review of the subject from these stand-points. The principal theories advanced as to the causation are obstruction to the arterial supply, interference with the return venous circulation, and compression and injury of the nerves.

The latter is looked upon by some writers, including Thomas, as a secondary and contributing but not a necessary factor in its causation. In over one-half of the cases symptoms of nerve involvement were present. Tight bandaging is not always a factor in the etiology. Whatever the cause, the changes in the muscles involved are very striking, both macroscopically and microscopically. They are found to be yellow in color, hard, contracted, the nuclei and transverse striations lost, and the connective-tissue elements increased.

Treatment is oftentimes unsatisfactory. Operative measures include lengthening of the contracted muscles by plastic operations on the tendons or, better still, upon the muscles, freeing of the nerves, and shortening of the bones by resection.

DR. GWILYM G. DAVIS said that he had seen some of these cases. Personally he was inclined to think the nerves play a very considerable part in the deformity produced. In the picture which Dr. Jopson had passed around the position assumed by the

hand was almost absolutely that of ulnar paralysis. The extension of the proximal phalanges and the contraction of the distal and middle ones was most typical of that which resulted when the ulnar nerve is injured. It is believed that the injury of the median nerve does not cause so much trouble, because its distribution in the hand, as far as motor influence goes, is comparatively slight, therefore when the two nerves are injured, as was apparently the case in Dr. Jopson's patient, the contraction of the muscles supplied by the ulnar nerve overshadows that of the muscles supplied by the median nerve, and the consequence is the typical contracture of Duchenne. On operation the muscles are found more or less bound together and the tendons to the nerves.

As regards the treatment, the most severe cases are at present almost hopeless, but there are a number of others not of the highest grade of severity for which very much can be done, and the line of treatment is perfectly clear. In the first place, one ought to lay back such a flap as will give proper access, and then follow the ulnar and median nerves down through the cicatrix, if necessary deliberately resecting them and uniting the ends again. As regards the tendons, they should be separated and lengthened in the manner followed by Dr. Jopson. Advantage should be taken of the fatty tissue to slip it in between the tendons, and also the use of Cargile membrane may be resorted to.

The same condition identically is produced by injuries of the forearm, the result of machinery accidents, and the same treatment is applicable.

DR. JAMES K. YOUNG said that something should be said of the manipulation in these cases in addition to the operative methods. After the operation it is advisable to manipulate them after the method of Robert Jones, of Liverpool. He showed in Washington this method, manipulating first the hand, holding the arm firm, and he claimed very good results. In addition to the operative treatment such manipulation of the parts will very much improve the condition.

DR. JOHN H. GIBBON remarked regarding the technic of anastomosis of tendons and nerves, calling attention to a method to prevent the fixation of the nerve in scar tissue. It is known that Cargile membrane and other kinds of material are used to prevent the fixation at the point of anastomosis, but it occurred

to him in making an incision to take one of the big superficial veins and make a cuff from it. He therefore resected about an inch and a half from one of the large veins, put it in salt solution until ready for it, then, resecting the nerve, slipped the cuff up on one end, brought the other end of the nerve up and sutured it, then slipped the cuff over the point of anastomosis. Although the result obtained in this case (one of long standing) was unsatisfactory, he believed the use of the superficial veins in this way would be a satisfactory method of preventing adhesions, which are so apt to occur at the line of anastomosis.

After performing this operation, he learned that some one else had thought of this method, although he had never heard of it.

DR. J. EDWIN SWEET called attention to a method of attaining the result desired by Dr. Gibbon—the use of veins or arteries of animals, stretched over glass rods and hardened in formalin, the formalin removed by washing in water, and the preparation then boiled. This method, suggested by Foramitti, has two advantages over the use of a fresh superficial vein: the one, that different sizes and lengths can be prepared and kept on hand; the other, that the tube thus prepared resists absorption longer than the fresh tissue, and would be less likely to become adherent in either the nerve or the surrounding structures.

FRACTURES OF THE PATELLA.

DR. E. G. ALEXANDER read a paper with this title, for which see page 508.

DR. WALTER G. ELMER, with regard to the statistical showing that fractures of the patella were slightly more numerous in the left knee, said that in the Hospital for Ruptured and Crippled Children in a series of several thousand cases of tuberculosis in which traumatism was supposed to play a part, 55 per cent. had the right knee affected; another series was slightly in favor of the left knee. In a recent medicolegal case, the counsel for the defendant and the witnesses on that side took the stand that the injury was greatly in favor of the right knee. These figures are valuable as showing that such could not be said to be the case, but that one knee was as likely to be the seat of injury as the other.

DR. JOHN B. DEEVER said that his experience in the treatment of fracture of the patella agrees with the views expressed by

Dr. Alexander. For the last two years he had adopted this method of treatment, and the results obtained had been better and the length of time in bringing about the result much shorter. Formerly it was his practice to put the knee up in plaster after wiring, taking the case off in ten days or two weeks, after the removal of which passive motion was cautiously made. He no longer uses plaster but treats as above stated.

Dr. JOHN H. GIBBON said that in dealing with this subject Dr. Alexander had looked at it from a distinctly modern point of view. He had said nothing about the older ways of treatment, either the subcutaneous suture or the straight incision. He believed this is the way it should be looked at. The time has passed when, if the environment for operation is proper, the patient should be treated with a splint. Of course care must be exercised in the choice of cases, for it is in the non-observance of this precaution that the mortality comes in. It is plain that alcoholics, syphilitics, and others offering general contraindication to operation should be excluded.

With regard to points of personal technic, his preference is for an incision going below the fracture at least an inch, for then in case infection should occur, it is not immediately over the line of fracture, and moreover if a refracture occurs, it is not a compound one. He had only used a straight incision once and a silver wire suture but once. He was very much impressed with Dr. Blake's article of some years ago on this subject, which emphasized the fact that the rupture of the lateral ligaments was often the most important part of the lesion, from a pathological point of view certainly one of the most important, and should therefore receive particular attention. He suggested suture of the lateral ligament and suture of the ligamentum patellæ without suture of the patella itself. Dr. Gibbon had done this in all his cases recently. The silver wire suture will not prevent a patella from breaking if it is going to break after a number of months. It is, however, the most aseptic suture that can be used. He sutured only the lateral ligament and the ligament over the patella. The mere fact that Dr. Alexander says refracture occurs late, usually after the eighth week, is against the use of non-absorbable sutures. Although in his last few cases he had used no drainage, he believed it to be a good method not to put the sutures in too close or too tight—to allow a certain amount of drainage in this manner.

Regarding the splint, after learning from Dr. Alexander what he had been doing, in his last case he took the splint off the second day, but the patient wished it replaced because he felt more comfortable with than without it.

If the fragments are exposed and the fibrous tissue is taken away, perfect bony union will result, and there is no necessity for keeping splints on for months. Early motion is the secret of the ultimate success in these cases. Those cases in which it is not employed ultimately get the same result but not so quickly.

DR. HARRY C. DEEVER said that the most important point in Dr. Alexander's paper was the after-treatment. He had not used the plaster case for a fracture of the patella for six years, nothing but silver wire. This fixes the fragment and makes it possible to begin passive movements early, often at the end of the seventh day. It is his rule to make general passive motion with light massage. These cases were able to get out of bed at the end of eighteen days and to flex their legs to a right angle shortly afterwards, and were discharged in four weeks.

He had had five cases in his private practice, and at the end of five weeks he considered each patient practically well. He would not advise flexing of the knee very strongly at an early date without suture of the fragments with silver wire.

DR. GEORGE G. ROSS had had one unfortunate experience so far as the incision for operation is concerned. He had always used the straight incision following Dr. Deaver's practice, but after hearing a discussion recommending the horseshoe incision, he had a patient, a stout woman, at the Germantown Hospital, upon whom he made a big wide horseshoe incision and wired the patella. On the fifth or sixth day gangrene of the flap developed, with infection of the knee-joint, and subsequent death of the patient. He therefore became a little skeptical regarding the propriety of this incision. He still believed the straight incision gives ample room and does not jeopardize the blood supply of the superficial fascia.

DR. JOHN H. JOPSON said that there was one point which had not been brought out with regard to the use of silver wire, which he thought to be of importance. Its use requires a drilling of the bone, which suture of the capsule does not. He formerly practised suture of the capsule alone, but in his recent cases he had drilled the fragments and used silver wire, as it seemed to

him such treatment might stimulate the osteogenetic function of the bone, even as in ununited fractures.

DR. GEORGE P. MÜLLER reported a case of recurrent bilateral fractures of the patella; the patient was shown to the Clinical Surgical Society recently. The left patella was first fractured in November, 1906, and was wired with silver wire in the usual manner; in January, 1907, a refracture of the patella occurred, and it was again wired. In April, 1907, as a result of a misstep, the patient refractured the patella again and this time it was fastened with chromic gut and has since remained united. In February, 1910, he fractured the right patella and on the ninth day after the accident this was sutured with chromic catgut and has since remained united. The patient stated that in 1906, at the time of his first fracture, his brother was operated on in the German Hospital with a fracture of the right patella which was refractured in 1909.

Dr. Müller had also seen a fracture of the patella caused by the kick of a horse, in which the lower half inch of the bone was fractured, without, as far as he was able to see, opening the joint. The fragments were in fairly good position, the lower end being tilted somewhat backward, but owing to the fact that the patient was very insistent that he should be able to ride horseback without trouble in the future, he advised operation and fastened the fragments with chromic gut. The patient was placed on a posterior splint for three or four days, a plaster cast was then applied, and on the tenth day he was allowed to walk on crutches. The cast was removed three weeks after operation and the patient allowed to walk, but he complained of inability to raise the foot and toe-drag, and upon examination he was found to be suffering from paralysis of the external popliteal nerve. The case was perfectly fitting and properly padded, and accordingly the speaker believed that the nerve was injured at the time of the accident with the kick of the horse.

In addition to the possibility of infection to the joint if the skin incision is placed immediately over the line of operation, as has been mentioned, it should be added that the scar in the skin is liable to adhere to the scar in the fascia and cause more or less trouble. A wait of two weeks at least should be observed before attempting any motion. It has been emphasized that the most important part of the operation is the suture in the torn aponeurosis and as fascial tissues are not very well vascularized they

should be given time to firmly unite. One does not, as a rule, allow patients operated upon for hernia to go about until the second week, and yet as a matter of fact there is less strain in these cases than in the flexion and extension of the knee-joint. If the torn aponeurosis is carefully and accurately brought together, it does not matter whether one uses silver wire, copper wire, or catgut in the patella, or whether one does not drill the patella but simply uses the mattress sutures of Blake or the circumferential suture. Personally, he preferred to drill the patella, for the reason mentioned by Dr. Jopson, *i.e.*, that it may have some influence in promoting bony union. The majority of surgeons have found silver wire unnecessary, but if an operator gets good results with silver wire he should use it.

DR. JOHN H. GIBBON remarked with regard to the horseshoe incision, that in all his early cases where he used the horseshoe-shaped incision he had no sloughing, but he realized it was wrong, and since then his incision had been more semilunar. He intended, when speaking before, to refer to a case of peroneal palsy, which he was sure was due to the splint. The patient had had no plaster cast, he was a very thin man; he complained of great pain over the peroneal nerve. When the splint was removed he had toe-drop, from which he very slowly recovered.

DR. A. P. C. ASHHURST said that if it was desired to get patients walking by the fourteenth day it was well to use silver wire, as union cannot be firm then. On the other hand, if they can wear a removable plaster cast, and have massage by an adequate masseur, with passive motion, it is sufficient to use chromic catgut for sutures.

A second point is that among 49 operations there were two deaths, a fact which should not be overlooked. These operations were done in one of the best hospitals, with the best surgeons and best assistants and nurses. Within the last few weeks there has been reported from Boston a series of arthrotomies for fatty tumors of the knee-joint. The mortality from infection was about 4 per cent. Lucas-Championnière, who despises asepsis, swabs out his knee-joints with carbolic acid, and claims to have done more than 80 operations for fracture of the patella without a single death. Perhaps, therefore, the aseptic is not so good as the antiseptic method.

DR. LEWIS W. STEINBACH exhibited a patient operated upon for fracture of the patella who was operated upon six weeks

before, four days after her admission to the Polyclinic Hospital. The large effusion of blood into the joint was washed out, the edges of the lacerated tendon and of the ligaments were trimmed, then the widely separated fragments of the transversely fractured patella were brought together through the fascia anteriorly and laterally of the patella. The joint was fixed with a thin silicate of soda dressing re-enforced by a posterior thin splint of wood, and then interrupted catgut sutures for the integument.

After 39 days spent in bed, the splint was removed. The bone was firmly united as shown by the skiagraph, the sutures were absorbed, and the joint had a fair degree of free motion. Patient can now walk with the aid of crutches, and it is reasonable to expect that she will soon possess normal use of the extremity.

DR. EMORY G. ALEXANDER (in closing) said, with regard to the mortality, that although the two deaths make a large percentage in this series, he felt that with the great work being done by Dr. Murphy on the knee-joint, and the advance made by English surgeons, the technic is bound to improve, and that with these improvements will come a decrease in the mortality rate.

As far as drainage is concerned, he did not advocate it as a routine measure, but occasionally there will form an extra-capsular collection due to oozing which must be removed. As to the comfort of the splint, with his patients it has always been the opposite, they saying that the pillow is much more comfortable as it allows of freer movement. There is a certain degree of motion of the knee, about 5° or 10° , which can be gradually produced without using the patella at all, and this is the motion advocated for the first few days, not forcibly flexing the knee. The majority of refractures occur after the eighth week, a point which shows the value of silver wire suture.

THE OPEN TREATMENT OF FRACTURES.

DR. EDWARD MARTIN made some remarks upon this subject.

FRACTURES OF THE SHAFT OF THE FEMUR WITH MARKED DISPLACEMENT.

DR. RICHARD H. HARTE read a paper with this title, for which see page 499.

DR. JAMES K. YOUNG said that in the treatment of vicious and ununited fractures Lambott's method is an improvement over

the Parkhill method. It consists in the use of screws, which are inserted directly in the bone without the use of the drill. The screws are drill pointed. The fracture is held in place with special forceps, by which they can be placed in better position, the apparatus held together with a part outside the soft parts, and, as has been demonstrated by Dr. Wills of Los Angeles, Dr. Robertson of Warren, Pa., and others, the fractures may be accurately set and held during union. After the apparatus has been in place for a time the screws may be readily removed by means of a key.

DR. GWILYM G. DAVIS said, relative to the method of approximation, that plates alone do not play such a very large part in the approximations of these fractures. In a bone which has big ends and is small in the middle, the ends are cancellous and the shaft is compact. A fracture of the ends is almost always transverse, and therefore the displacement is not great and the necessity of marked fixation at the ends does not exist. But in fractures of the shaft it is a different proposition. Compact bone is to be dealt with, and usually a fracture through compact tissue is oblique. In case of a transverse fracture in the shaft, a medullary splint should be used as Murphy has done. As regards the method of separating the fragments, it can be done by bending them up, and the splint can be sprung into place. In fractures of the shaft of the femur one cannot put on plates strong enough to hold them without the aid of outside force. Here a plaster-of-Paris bandage or outside splints are strongly indicated.

DR. JOHN B. ROBERTS said that the speakers seemed to be more sure of the reliability of measurements of the lower extremities after fracture than he was. A good many years ago he and others measured the bare bones of the lower extremities, and found that in limbs never subjected to fracture there was a marked difference between uninjured femurs and tibiae of the same individual. With even a considerable difference in the length of the lower legs, whether it be in the femur or in the tibia, the individual may walk with very little limp. Personally he paid very little attention to measurement of the legs after fracture of the thigh, but depended upon his eye as to the approximate amount of shortening, when he had the patient lying in bed with the pelvis straight. Although he used X-ray pictures for confirming the clinical examination, he realized that they may be very

deceptive, and should never be used in court without the recognition by all parties that an expert radiographer may make very deceptive pictures. Such deceptive pictures are very likely to be made, unless the man who takes them knows the anatomy of the region and the probable site of the fracture before the exposure to the X-ray is made and takes plates in two planes.

Nature approximates symmetry in the skeleton, but hardly ever reaches it. X-ray plates are an assistance in surgical work, but the results must be checked up by clinical examination, by inspection, palpation, etc. He had long advocated the open treatment of fractures under special circumstances. He was inclined to believe, however, that it is by no means true that the majority of fractures should be treated by open method. Many fractures of the femur, in addition to permanent traction to overcome shortening, need lateral support by plaster-of-Paris or other splints. The cases which are particularly likely to require incision and open treatment are the fractures near the junction of the upper and middle third of the femur, where eversion and flexion at the hip-joint are liable to occur from the action of the psoas and iliacus muscles.

He had noticed in this discussion that the word plaster "cast" has been used a good deal as a method of treating fractures. It is rather odd that surgeons are very apt to use this improper term. The encasements which are often used in fractures of long bones should never be called "casts." They are not casts. They are really moulds. A better term instead of plaster cast is gypsum encasement or gypsum splint.

DR. GEORGE E. PFAHLER presented a skiagraph made two weeks before, showing the remarkable power of nature to unite fractures. In this instance, the bones overlapped about one inch, and even then the sides of the two fragments were about half an inch apart. Nature has bridged this gap. When sending patients for examination, in dressings, the surgeon should mark on the dressings approximately the location of the fracture, so as to be able to bring the central ray over the line of fracture. To determine the position of the fragments stereoscopic plates should be made, or two plates should be made at right angles to each other. When this work is accurately done and properly interpreted there can be no error.

DR. A. P. C. ASHHURST said that the enthusiastic Mr. Lane

and some of his colleagues in England seem to think that the results without operation are intolerable. Dr. Harte and Dr. Martin, however, believe that certain cases do very well without operation, and recommend operation only in certain selected cases. Two years ago with the aid of the interne at the Episcopal Hospital, Dr. Ashhurst traced six cases of fracture of the femur, including forty of the shaft, and they found that 60 per cent. of the fractures of the shaft got a perfect result, while 32.5 per cent. more, making 90 per cent. in all, had no disability other than a slight limp. It seemed to him that those who advocate operation in all cases might at least publish the results of operative treatment, and let it be seen if in as large a series of cases as excellent results as these can be obtained.

DR. RICHARD H. HARTE (in closing) said that he agreed with all the gentlemen who had spoken in discussing these papers, but he would like to ask why is it that in all cases of fracture of the thigh Dr. Roberts has shortening? Is the broken leg always the short leg? Of course it is known that there is a certain amount of asymmetry in the results, but the man who treats a broken thigh without careful and accurate measurements is not giving his patient the best chance for good results.

With regard to broken plates, the trouble is that the plates ordinarily used are tempered too high, for if properly tempered and made of good steel it should be possible to bend them double and back again without breaking them. The old silver plates were far too easily bent and offered no support whatever.

Dr. Ashhurst speaks of a perfect result. What is meant by this term? Dr. Harte's idea of it is a limb that is perfectly straight, the patient walking without any limp, and no irregularity to be detected in the measurements. These are difficult to obtain.

He emphasized that he did not advocate that every fracture of the thigh should be opened and plated, but he did think this procedure to be indicated in cases where there is difficulty in keeping the fragments in position.

The mortality in these accidents should not be as great as they are in opening and wiring the patella, because in this latter operation there are two complicating conditions, a little bone to work on, and an opening into the joint in the body which is least calculated to take care of itself in infection.

CORRESPONDENCE.

CHOLELITHIASIS—FOURTEEN THOUSAND CALCULI REMOVED AT OPERATION.

WITH a view of adding to the literature of gall-stone surgery, the following case is reported, believing that the very unusual number of stones found fully justifies its presentation.

The patient was an unmarried woman, aged 52 years, who was referred to me through the kindness of Dr. George F. Simpson. Her family and personal history were negative.

Eighteen years ago she first experienced epigastric pain and vomiting. Pain came suddenly and disappeared suddenly. No further trouble for months. Then renewed attack with moderate pain and nausea but no vomiting. About a year thereafter a third attack occurred similar to the preceding. Then followed a period of quiescence lasting four or five years. After this attacks recurred about every six months. About eight years ago patient began having attacks every month, and noticed that there was a tendency for them to increase in severity, hold on longer, and return more frequently. At times they would continue throughout the night. Recently the attacks increased decidedly in frequency and severity. Nearly always vomited. No jaundice at any time. Marked chronic constipation. Pain at the ensiform cartilage, or to the right, and when it radiated it would be around the right rib toward the inferior scapular angle. During the last four years she lost 50 pounds in weight.

Operation: In the presence of Dr. Jacob Weber, Dr. Paul H. Greenleaf, of Lexington, Illinois, and with the assistance of Dr. George F. Simpson, the operation was performed at St. Mary and Elizabeth Hospital. An attempt to aspirate the bile by means of a trocar was made without success. Upon withdrawing the trocar, it was found to be clogged with a number of small stones. The appearance of the gall-bladder being perfectly symmetrical, it was not suspected that its distention was absolutely and literally due entirely to the stones. It was incised and the

stones removed. The wall of the gall-bladder was twice the usual thickness, but otherwise the organ was serviceable in its appearance. Some bile made its appearance at the close of the operation. The patient was discharged cured. More than a year and a half has elapsed and there has been no return of the symptoms. The volume of stones was so enormous that I detailed a responsible person to make an accurate count.

During the operation, it was estimated that at least 200 stones of small size were lost in the gauze surrounding the gall-bladder and in the act of transferring the stones to the receiver. These were not included in the count. The total number of stones removed that were counted reached the sum of 13,832, and if we include those stones that were lost we would feel safe in saying that the gall-bladder contained over 14,000 stones.

A careful search of the cystic and common duct did not reveal the presence of any stones.

The stones varied in size from that of a white mustard seed to that of a grain of corn. Roughly speaking, about 75 per cent. of the stones were the size of the mustard seed. The other 25 per cent. varied. No stones were broken and all the small ones were distinct and perfectly formed.

Desiring to collect other cases in which an unusual number of stones were found, letters of inquiry were addressed to several operators. The following answers are the result of this inquiry:

"In answer to your letter I have much pleasure in telling you the greatest number of gall-stones I have removed from one patient is 2300. They were bilirubin calculi from a female patient, age 27, and were taken from the gall-bladder, cystic, common, and hepatic ducts. The next largest number was 1058, was a man, aged 51, the next 720, the next 607, and another 568. In many cases I have removed numbers to correspond to these latter ones.

(Signed) A. W. Mayo Robson."

"I have removed in one case over 7000 stones from the gall-bladder, and over 3000 in another case from the common duct; in the latter case also there were several hundreds left uncounted. In both cases, of course, all the stones were quite small.

(Signed) B. G. A. Moynihan."

"We have had a number of cases in which there were a very large number of stones removed. The largest number we have counted was between five and six thousand.

(Signed) W. J. Mayo."

"The case in which I found the most gall-stones was that of a young man about 30 years of age who had 6780 stones from the size of half-a-grain of rice to twice the diameter of a pea.

(Signed) A. J. Ochsner."

"Answering your letter I beg to say, recently I operated upon a case of cholelithiasis, doing cholecystectomy, in which there were 2252 calculi.

(Signed) John B. Deaver."

Some cases in which a large number of stones were removed post mortem are recorded by B. G. A. Moynihan, "Gall-Stones and Their Surgical Treatment," page 34, as follows:

"Frerichs, in a woman sixty-one years of age, found 1950 stones, Dunlop (*Lancet*, 1878), in a woman of ninety-four, found 2011, Morgagni 3000, Hoffman 3646, Lagenbuch 4000, Naunyn 5000, and Otto 7802."

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